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(54) Title: G-PROTEIN COUPLED RECEPTORS

(57) Abstract: The invention provides human G-protein coupled receptors (GCREC) and polynucleotides which identify and encode GCREC. The invention also provides expression vectors, host cells, antibodies, agonists, and antagonists. The invention also provides methods for diagnosing, treating, or preventing disorders associated with aberrant expression of GCREC.



WO 01/90359 A2

G-PROTEIN COUPLED RECEPTORS

TECHNICAL FIELD

This invention relates to nucleic acid and amino acid sequences of G-protein coupled
5 receptors and to the use of these sequences in the diagnosis, treatment, and prevention of cell
proliferative, neurological, cardiovascular, gastrointestinal, autoimmune/inflammatory, and metabolic
disorders, and viral infections, and in the assessment of the effects of exogenous compounds on the
expression of nucleic acid and amino acid sequences of G-protein coupled receptors.

BACKGROUND OF THE INVENTION

Signal transduction is the general process by which cells respond to extracellular signals.
Signal transduction across the plasma membrane begins with the binding of a signal molecule, e.g., a
hormone, neurotransmitter, or growth factor, to a cell membrane receptor. The receptor, thus
activated, triggers an intracellular biochemical cascade that ends with the activation of an intracellular
15 target molecule, such as a transcription factor. This process of signal transduction regulates all types
of cell functions including cell proliferation, differentiation, and gene transcription. The G-protein
coupled receptors (GPCRs), encoded by one of the largest families of genes yet identified, play a
central role in the transduction of extracellular signals across the plasma membrane. GPCRs have a
proven history of being successful therapeutic targets.

20 GPCRs are integral membrane proteins characterized by the presence of seven hydrophobic
transmembrane domains which together form a bundle of antiparallel alpha (α) helices. GPCRs range
in size from under 400 to over 1000 amino acids (Strosberg, A.D. (1991) *Eur. J. Biochem.* 196:1-10;
Coughlin, S.R. (1994) *Curr. Opin. Cell Biol.* 6:191-197). The amino-terminus of a GPCR is
extracellular, is of variable length, and is often glycosylated. The carboxy-terminus is cytoplasmic
25 and generally phosphorylated. Extracellular loops alternate with intracellular loops and link the
transmembrane domains. Cysteine disulfide bridges linking the second and third extracellular loops
may interact with agonists and antagonists. The most conserved domains of GPCRs are the
transmembrane domains and the first two cytoplasmic loops. The transmembrane domains account,
in part, for structural and functional features of the receptor. In most cases, the bundle of α helices
30 forms a ligand-binding pocket. The extracellular N-terminal segment, or one or more of the three
extracellular loops, may also participate in ligand binding. Ligand binding activates the receptor by
inducing a conformational change in intracellular portions of the receptor. In turn, the large, third
intracellular loop of the activated receptor interacts with a heterotrimeric guanine nucleotide binding
(G) protein complex which mediates further intracellular signaling activities, including the activation
35 of second messengers such as cyclic AMP (cAMP), phospholipase C, and inositol triphosphate, and

the interaction of the activated GPCR with ion channel proteins. (See, e.g., Watson, S. and S. Arkinstall (1994) The G-protein Linked Receptor Facts Book, Academic Press, San Diego CA, pp. 2-6; Bolander, F.F. (1994) Molecular Endocrinology, Academic Press, San Diego CA, pp. 162-176; Baldwin, J.M. (1994) *Curr. Opin. Cell Biol.* 6:180-190.)

5 GPCRs include receptors for sensory signal mediators (e.g., light and olfactory stimulatory molecules); adenosine, γ -aminobutyric acid (GABA), hepatocyte growth factor, melanocortins, neuropeptide Y, opioid peptides, opsins, somatostatin, tachykinins, vasoactive intestinal polypeptide family, and vasopressin; biogenic amines (e.g., dopamine, epinephrine and norepinephrine, histamine, glutamate (metabotropic effect), acetylcholine (muscarinic effect), and serotonin); chemokines; lipid
10 mediators of inflammation (e.g., prostaglandins and prostanoids, platelet activating factor, and leukotrienes); and peptide hormones (e.g., bombesin, bradykinin, calcitonin, C5a anaphylatoxin, endothelin, follicle-stimulating hormone (FSH), gonadotropic-releasing hormone (GnRH), neurokinin, and thyrotropin-releasing hormone (TRH), and oxytocin). GPCRs which act as receptors for stimuli that have yet to be identified are known as orphan receptors.

15 The diversity of the GPCR family is further increased by alternative splicing. Many GPCR genes contain introns, and there are currently over 30 such receptors for which splice variants have been identified. The largest number of variations are at the protein C-terminus. N-terminal and cytoplasmic loop variants are also frequent, while variants in the extracellular loops or transmembrane domains are less common. Some receptors have more than one site at which variance
20 can occur. The splicing variants appear to be functionally distinct, based upon observed differences in distribution, signaling, coupling, regulation, and ligand binding profiles (Kilpatrick, G.J. et al. (1999) *Trends Pharmacol. Sci.* 20:294-301).

GPCRs can be divided into three major subfamilies: the rhodopsin-like, secretin-like, and metabotropic glutamate receptor subfamilies. Members of these GPCR subfamilies share similar
25 functions and the characteristic seven transmembrane structure, but have divergent amino acid sequences. The largest family consists of the rhodopsin-like GPCRs, which transmit diverse extracellular signals including hormones, neurotransmitters, and light. Rhodopsin is a photosensitive GPCR found in animal retinas. In vertebrates, rhodopsin molecules are embedded in membranous stacks found in photoreceptor (rod) cells. Each rhodopsin molecule responds to a photon of light by
30 triggering a decrease in cGMP levels which leads to the closure of plasma membrane sodium channels. In this manner, a visual signal is converted to a neural impulse. Other rhodopsin-like GPCRs are directly involved in responding to neurotransmitters. These GPCRs include the receptors for adrenaline (adrenergic receptors), acetylcholine (muscarinic receptors), adenosine, galanin, and glutamate (N-methyl-D-aspartate/NMDA receptors). (Reviewed in Watson, S. and S. Arkinstall
35 (1994) The G-Protein Linked Receptor Facts Book, Academic Press, San Diego CA, pp. 7-9, 19-22,

32-35, 130-131, 214-216, 221-222; Habert-Ortoli, E. et al. (1994) Proc. Natl. Acad. Sci. USA 91:9780-9783.)

The galanin receptors mediate the activity of the neuroendocrine peptide galanin, which inhibits secretion of insulin, acetylcholine, serotonin and noradrenaline, and stimulates prolactin and growth hormone release. Galanin receptors are involved in feeding disorders, pain, depression, and Alzheimer's disease (Kask, K. et al. (1997) Life Sci. 60:1523-1533). Other nervous system rhodopsin-like GPCRs include a growing family of receptors for lysophosphatidic acid and other lysophospholipids, which appear to have roles in development and neuropathology (Chun, J. et al. (1999) Cell Biochem. Biophys. 30:213-242).

10 The largest subfamily of GPCRs, the olfactory receptors, are also members of the rhodopsin-like GPCR family. These receptors function by transducing odorant signals. Numerous distinct olfactory receptors are required to distinguish different odors. Each olfactory sensory neuron expresses only one type of olfactory receptor, and distinct spatial zones of neurons expressing distinct receptors are found in nasal passages. For example, the RA1c receptor which was isolated from a rat brain library, has been shown to be limited in expression to very distinct regions of the brain and a defined zone of the olfactory epithelium (Raming, K. et al. (1998) Receptors Channels 6:141-151). However, the expression of olfactory-like receptors is not confined to olfactory tissues. For example, three rat genes encoding olfactory-like receptors having typical GPCR characteristics showed expression patterns not only in taste and olfactory tissue, but also in male reproductive tissue
15 (Thomas, M.B. et al. (1996) Gene 178:1-5).

Members of the secretin-like GPCR subfamily have as their ligands peptide hormones such as secretin, calcitonin, glucagon, growth hormone-releasing hormone, parathyroid hormone, and vasoactive intestinal peptide. For example, the secretin receptor responds to secretin, a peptide hormone that stimulates the secretion of enzymes and ions in the pancreas and small intestine
25 (Watson, *supra*, pp. 278-283). Secretin receptors are about 450 amino acids in length and are found in the plasma membrane of gastrointestinal cells. Binding of secretin to its receptor stimulates the production of cAMP.

Examples of secretin-like GPCRs implicated in inflammation and the immune response include the EGF module-containing, mucin-like hormone receptor (Emr1) and CD97 receptor
30 proteins. These GPCRs are members of the recently characterized EGF-TM7 receptors subfamily. These seven transmembrane hormone receptors exist as heterodimers *in vivo* and contain between three and seven potential calcium-binding EGF-like motifs. CD97 is predominantly expressed in leukocytes and is markedly upregulated on activated B and T cells (McKnight, A.J. and S. Gordon (1998) J. Leukoc. Biol. 63:271-280).

35 The third GPCR subfamily is the metabotropic glutamate receptor family. Glutamate is the

major excitatory neurotransmitter in the central nervous system. The metabotropic glutamate receptors modulate the activity of intracellular effectors, and are involved in long-term potentiation (Watson, supra, p.130). The Ca^{2+} -sensing receptor, which senses changes in the extracellular concentration of calcium ions, has a large extracellular domain including clusters of acidic amino acids which may be involved in calcium binding. The metabotropic glutamate receptor family also includes pheromone receptors, the GABA_B receptors, and the taste receptors.

Other subfamilies of GPCRs include two groups of chemoreceptor genes found in the nematodes Caenorhabditis elegans and Caenorhabditis briggsae, which are distantly related to the mammalian olfactory receptor genes. The yeast pheromone receptors STE2 and STE3, involved in the response to mating factors on the cell membrane, have their own seven-transmembrane signature, as do the cAMP receptors from the slime mold Dictyostelium discoideum, which are thought to regulate the aggregation of individual cells and control the expression of numerous developmentally-regulated genes.

GPCR mutations, which may cause loss of function or constitutive activation, have been associated with numerous human diseases (Coughlin, supra). For instance, retinitis pigmentosa may arise from mutations in the rhodopsin gene. Furthermore, somatic activating mutations in the thyrotropin receptor have been reported to cause hyperfunctioning thyroid adenomas, suggesting that certain GPCRs susceptible to constitutive activation may behave as protooncogenes (Parma, J. et al. (1993) Nature 365:649-651). GPCR receptors for the following ligands also contain mutations associated with human disease: luteinizing hormone (precocious puberty); vasopressin V_2 (X-linked nephrogenic diabetes); glucagon (diabetes and hypertension); calcium (hyperparathyroidism, hypocalcemia, hypercalcemia); parathyroid hormone (short limbed dwarfism); β_3 -adrenoceptor (obesity, non-insulin-dependent diabetes mellitus); growth hormone releasing hormone (dwarfism); and adrenocorticotropin (glucocorticoid deficiency) (Wilson, S. et al. (1998) Br. J. Pharmacol. 125:1387-1392; Stadel, J.M. et al. (1997) Trends Pharmacol. Sci. 18:430-437). GPCRs are also involved in depression, schizophrenia, sleeplessness, hypertension, anxiety, stress, renal failure, and several cardiovascular disorders (Horn, F. and G. Vriend (1998) J. Mol. Med. 76:464-468).

In addition, within the past 20 years several hundred new drugs have been recognized that are directed towards activating or inhibiting GPCRs. The therapeutic targets of these drugs span a wide range of diseases and disorders, including cardiovascular, gastrointestinal, and central nervous system disorders as well as cancer, osteoporosis and endometriosis (Wilson, supra; Stadel, supra). For example, the dopamine agonist L-dopa is used to treat Parkinson's disease, while a dopamine antagonist is used to treat schizophrenia and the early stages of Huntington's disease. Agonists and antagonists of adrenoceptors have been used for the treatment of asthma, high blood pressure, other cardiovascular disorders, and anxiety; muscarinic agonists are used in the treatment of glaucoma and

tachycardia; serotonin 5HT_{1D} antagonists are used against migraine; and histamine H₁ antagonists are used against allergic and anaphylactic reactions, hay fever, itching, and motion sickness (Horn, supra).

Recent research suggests potential future therapeutic uses for GPCRs in the treatment of metabolic disorders including diabetes, obesity, and osteoporosis. For example, mutant V2 vasopressin receptors causing nephrogenic diabetes could be functionally rescued in vitro by co-expression of a C-terminal V2 receptor peptide spanning the region containing the mutations. This result suggests a possible novel strategy for disease treatment (Schöneberg, T. et al. (1996) EMBO J. 15:1283-1291). Mutations in melanocortin-4 receptor (MC4R) are implicated in human weight regulation and obesity. As with the vasopressin V2 receptor mutants, these MC4R mutants are defective in trafficking to the plasma membrane (Ho, G. and R.G. MacKenzie (1999) J. Biol. Chem. 274:35816-35822), and thus might be treated with a similar strategy. The type 1 receptor for parathyroid hormone (PTH) is a GPCR that mediates the PTH-dependent regulation of calcium homeostasis in the bloodstream. Study of PTH/receptor interactions may enable the development of novel PTH receptor ligands for the treatment of osteoporosis (Mannstadt, M. et al. (1999) Am. J. Physiol. 277:F665-F675).

The chemokine receptor group of GPCRs have potential therapeutic utility in inflammation and infectious disease. (For review, see Locati, M. and P.M. Murphy (1999) Annu. Rev. Med. 50:425-440.) Chemokines are small polypeptides that act as intracellular signals in the regulation of leukocyte trafficking, hematopoiesis, and angiogenesis. Targeted disruption of various chemokine receptors in mice indicates that these receptors play roles in pathologic inflammation and in autoimmune disorders such as multiple sclerosis. Chemokine receptors are also exploited by infectious agents, including herpesviruses and the human immunodeficiency virus (HIV-1) to facilitate infection. A truncated version of chemokine receptor CCR5, which acts as a coreceptor for infection of T-cells by HIV-1, results in resistance to AIDS, suggesting that CCR5 antagonists could be useful in preventing the development of AIDS.

The discovery of new G-protein coupled receptors and the polynucleotides encoding them satisfies a need in the art by providing new compositions which are useful in the diagnosis, prevention, and treatment of cell proliferative, neurological, cardiovascular, gastrointestinal, autoimmune/inflammatory, and metabolic disorders, and viral infections, and in the assessment of the effects of exogenous compounds on the expression of nucleic acid and amino acid sequences of G-protein coupled receptors.

SUMMARY OF THE INVENTION

The invention features purified polypeptides, G-protein coupled receptors, referred to

collectively as "GCREC" and individually as "GCREC-1," "GCREC-2," "GCREC-3," "GCREC-4," "GCREC-5," "GCREC-6," "GCREC-7," "GCREC-8," "GCREC-9," "GCREC-10," "GCREC-11," "GCREC-12," "GCREC-13," "GCREC-14," "GCREC-15," "GCREC-16," "GCREC-17," "GCREC-18," "GCREC-19," "GCREC-20," "GCREC-21," "GCREC-22," and "GCREC-23." In one aspect, the invention provides an isolated polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23. In one alternative, the invention provides an isolated polypeptide comprising the amino acid sequence of SEQ ID NO:1-23.

The invention further provides an isolated polynucleotide encoding a polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23. In one alternative, the polynucleotide encodes a polypeptide selected from the group consisting of SEQ ID NO:1-23. In another alternative, the polynucleotide is selected from the group consisting of SEQ ID NO:24-46.

Additionally, the invention provides a recombinant polynucleotide comprising a promoter sequence operably linked to a polynucleotide encoding a polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23. In one alternative, the invention provides a cell transformed with the recombinant polynucleotide. In another alternative, the invention provides a transgenic organism comprising the recombinant polynucleotide.

The invention also provides a method for producing a polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide comprising an amino acid sequence at least

90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23. The method comprises a) 5 culturing a cell under conditions suitable for expression of the polypeptide, wherein said cell is transformed with a recombinant polynucleotide comprising a promoter sequence operably linked to a polynucleotide encoding the polypeptide, and b) recovering the polypeptide so expressed.

Additionally, the invention provides an isolated antibody which specifically binds to a polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid 10 sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ 15 ID NO:1-23.

The invention further provides an isolated polynucleotide selected from the group consisting of a) a polynucleotide comprising a polynucleotide sequence selected from the group consisting of SEQ ID NO:24-46, b) a naturally occurring polynucleotide comprising a polynucleotide sequence at least 90% identical to a polynucleotide sequence selected from the group consisting of SEQ ID 20 NO:24-46, c) a polynucleotide complementary to the polynucleotide of a), d) a polynucleotide complementary to the polynucleotide of b), and e) an RNA equivalent of a)-d). In one alternative, the polynucleotide comprises at least 60 contiguous nucleotides.

Additionally, the invention provides a method for detecting a target polynucleotide in a sample, said target polynucleotide having a sequence of a polynucleotide selected from the group 25 consisting of a) a polynucleotide comprising a polynucleotide sequence selected from the group consisting of SEQ ID NO:24-46, b) a naturally occurring polynucleotide comprising a polynucleotide sequence at least 90% identical to a polynucleotide sequence selected from the group consisting of SEQ ID NO:24-46, c) a polynucleotide complementary to the polynucleotide of a), d) a polynucleotide complementary to the polynucleotide of b), and e) an RNA equivalent of a)-d). The 30 method comprises a) hybridizing the sample with a probe comprising at least 20 contiguous nucleotides comprising a sequence complementary to said target polynucleotide in the sample, and which probe specifically hybridizes to said target polynucleotide, under conditions whereby a hybridization complex is formed between said probe and said target polynucleotide or fragments thereof, and b) detecting the presence or absence of said hybridization complex, and optionally, if 35 present, the amount thereof. In one alternative, the probe comprises at least 60 contiguous

nucleotides.

The invention further provides a method for detecting a target polynucleotide in a sample, said target polynucleotide having a sequence of a polynucleotide selected from the group consisting of a) a polynucleotide comprising a polynucleotide sequence selected from the group consisting of
5 SEQ ID NO:24-46, b) a naturally occurring polynucleotide comprising a polynucleotide sequence at least 90% identical to a polynucleotide sequence selected from the group consisting of SEQ ID NO:24-46, c) a polynucleotide complementary to the polynucleotide of a), d) a polynucleotide complementary to the polynucleotide of b), and e) an RNA equivalent of a)-d). The method comprises a) amplifying said target polynucleotide or fragment thereof using polymerase chain
10 reaction amplification, and b) detecting the presence or absence of said amplified target polynucleotide or fragment thereof, and, optionally, if present, the amount thereof.

The invention further provides a composition comprising an effective amount of a polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide
15 comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and a pharmaceutically acceptable excipient. In one embodiment, the composition
20 comprises an amino acid sequence selected from the group consisting of SEQ ID NO:1-23. The invention additionally provides a method of treating a disease or condition associated with decreased expression of functional GCREC, comprising administering to a patient in need of such treatment the composition.

The invention also provides a method for screening a compound for effectiveness as an
25 agonist of a polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23,
30 and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23. The method comprises a) exposing a sample comprising the polypeptide to a compound, and b) detecting agonist activity in the sample. In one alternative, the invention provides a composition comprising an agonist compound identified by the method and a pharmaceutically acceptable excipient. In another alternative, the invention provides a method of
35 treating a disease or condition associated with decreased expression of functional GCREC,

comprising administering to a patient in need of such treatment the composition.

Additionally, the invention provides a method for screening a compound for effectiveness as an antagonist of a polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23. The method comprises a) exposing a sample comprising the polypeptide to a compound, and b) detecting antagonist activity in the sample. In one alternative, the invention provides a composition comprising an antagonist compound identified by the method and a pharmaceutically acceptable excipient. In another alternative, the invention provides a method of treating a disease or condition associated with overexpression of functional GCREC, comprising administering to a patient in need of such treatment the composition.

The invention further provides a method of screening for a compound that specifically binds to a polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23. The method comprises a) combining the polypeptide with at least one test compound under suitable conditions, and b) detecting binding of the polypeptide to the test compound, thereby identifying a compound that specifically binds to the polypeptide.

The invention further provides a method of screening for a compound that modulates the activity of a polypeptide selected from the group consisting of a) a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, b) a naturally occurring polypeptide comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23. The method comprises a) combining the polypeptide with at least one test compound under conditions permissive for the activity of the polypeptide, b) assessing the activity of the polypeptide in the presence of the test compound, and c) comparing the activity of the polypeptide in the presence of the test compound with the activity of the polypeptide in the

absence of the test compound, wherein a change in the activity of the polypeptide in the presence of the test compound is indicative of a compound that modulates the activity of the polypeptide.

The invention further provides a method for screening a compound for effectiveness in altering expression of a target polynucleotide, wherein said target polynucleotide comprises a sequence selected from the group consisting of SEQ ID NO:24-46, the method comprising a) exposing a sample comprising the target polynucleotide to a compound, and b) detecting altered expression of the target polynucleotide.

The invention further provides a method for assessing toxicity of a test compound, said method comprising a) treating a biological sample containing nucleic acids with the test compound; b) hybridizing the nucleic acids of the treated biological sample with a probe comprising at least 20 contiguous nucleotides of a polynucleotide selected from the group consisting of i) a polynucleotide comprising a polynucleotide sequence selected from the group consisting of SEQ ID NO:24-46, ii) a naturally occurring polynucleotide comprising a polynucleotide sequence at least 90% identical to a polynucleotide sequence selected from the group consisting of SEQ ID NO:24-46, iii) a polynucleotide having a sequence complementary to i), iv) a polynucleotide complementary to the polynucleotide of ii), and v) an RNA equivalent of i)-iv). Hybridization occurs under conditions whereby a specific hybridization complex is formed between said probe and a target polynucleotide in the biological sample, said target polynucleotide selected from the group consisting of i) a polynucleotide comprising a polynucleotide sequence selected from the group consisting of SEQ ID NO:24-46, ii) a naturally occurring polynucleotide comprising a polynucleotide sequence at least 90% identical to a polynucleotide sequence selected from the group consisting of SEQ ID NO:24-46, iii) a polynucleotide complementary to the polynucleotide of i), iv) a polynucleotide complementary to the polynucleotide of ii), and v) an RNA equivalent of i)-iv). Alternatively, the target polynucleotide comprises a fragment of a polynucleotide sequence selected from the group consisting of i)-v) above; c) quantifying the amount of hybridization complex; and d) comparing the amount of hybridization complex in the treated biological sample with the amount of hybridization complex in an untreated biological sample, wherein a difference in the amount of hybridization complex in the treated biological sample is indicative of toxicity of the test compound.

BRIEF DESCRIPTION OF THE TABLES

Table 1 summarizes the nomenclature for the full length polynucleotide and polypeptide sequences of the present invention.

Table 2 shows the GenBank identification number and annotation of the nearest GenBank homolog for polypeptides of the invention. The probability score for the match between each polypeptide and its GenBank homolog is also shown.

Table 3 shows structural features of polypeptide sequences of the invention, including predicted motifs and domains, along with the methods, algorithms, and searchable databases used for analysis of the polypeptides.

Table 4 lists the cDNA and/or genomic DNA fragments which were used to assemble
5 polynucleotide sequences of the invention, along with selected fragments of the polynucleotide sequences.

Table 5 shows the representative cDNA library for polynucleotides of the invention.

Table 6 provides an appendix which describes the tissues and vectors used for construction of the cDNA libraries shown in Table 5.

10 Table 7 shows the tools, programs, and algorithms used to analyze the polynucleotides and polypeptides of the invention, along with applicable descriptions, references, and threshold parameters.

Table 8 shows tissue-specific expression of polynucleotides of the invention.

15

DESCRIPTION OF THE INVENTION

Before the present proteins, nucleotide sequences, and methods are described, it is understood that this invention is not limited to the particular machines, materials and methods described, as these may vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to limit the scope of the present invention which
20 will be limited only by the appended claims.

It must be noted that as used herein and in the appended claims, the singular forms "a," "an," and "the" include plural reference unless the context clearly dictates otherwise. Thus, for example, a reference to "a host cell" includes a plurality of such host cells, and a reference to "an antibody" is a reference to one or more antibodies and equivalents thereof known to those skilled in the art, and so
25 forth.

Unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art to which this invention belongs. Although any machines, materials, and methods similar or equivalent to those described herein can be used to practice or test the present invention, the preferred machines, materials and methods are now
30 described. All publications mentioned herein are cited for the purpose of describing and disclosing the cell lines, protocols, reagents and vectors which are reported in the publications and which might be used in connection with the invention. Nothing herein is to be construed as an admission that the invention is not entitled to antedate such disclosure by virtue of prior invention.

DEFINITIONS

35 "GCREC" refers to the amino acid sequences of substantially purified GCREC obtained from

any species, particularly a mammalian species, including bovine, ovine, porcine, murine, equine, and human, and from any source, whether natural, synthetic, semi-synthetic, or recombinant.

The term "agonist" refers to a molecule which intensifies or mimics the biological activity of GCREC. Agonists may include proteins, nucleic acids, carbohydrates, small molecules, or any other compound or composition which modulates the activity of GCREC either by directly interacting with GCREC or by acting on components of the biological pathway in which GCREC participates.

An "allelic variant" is an alternative form of the gene encoding GCREC. Allelic variants may result from at least one mutation in the nucleic acid sequence and may result in altered mRNAs or in polypeptides whose structure or function may or may not be altered. A gene may have none, one, or many allelic variants of its naturally occurring form. Common mutational changes which give rise to allelic variants are generally ascribed to natural deletions, additions, or substitutions of nucleotides. Each of these types of changes may occur alone, or in combination with the others, one or more times in a given sequence.

"Altered" nucleic acid sequences encoding GCREC include those sequences with deletions, insertions, or substitutions of different nucleotides, resulting in a polypeptide the same as GCREC or a polypeptide with at least one functional characteristic of GCREC. Included within this definition are polymorphisms which may or may not be readily detectable using a particular oligonucleotide probe of the polynucleotide encoding GCREC, and improper or unexpected hybridization to allelic variants, with a locus other than the normal chromosomal locus for the polynucleotide sequence encoding GCREC. The encoded protein may also be "altered," and may contain deletions, insertions, or substitutions of amino acid residues which produce a silent change and result in a functionally equivalent GCREC. Deliberate amino acid substitutions may be made on the basis of similarity in polarity, charge, solubility, hydrophobicity, hydrophilicity, and/or the amphipathic nature of the residues, as long as the biological or immunological activity of GCREC is retained. For example, negatively charged amino acids may include aspartic acid and glutamic acid, and positively charged amino acids may include lysine and arginine. Amino acids with uncharged polar side chains having similar hydrophilicity values may include: asparagine and glutamine; and serine and threonine. Amino acids with uncharged side chains having similar hydrophilicity values may include: leucine, isoleucine, and valine; glycine and alanine; and phenylalanine and tyrosine.

The terms "amino acid" and "amino acid sequence" refer to an oligopeptide, peptide, polypeptide, or protein sequence, or a fragment of any of these, and to naturally occurring or synthetic molecules. Where "amino acid sequence" is recited to refer to a sequence of a naturally occurring protein molecule, "amino acid sequence" and like terms are not meant to limit the amino acid sequence to the complete native amino acid sequence associated with the recited protein molecule.

"Amplification" relates to the production of additional copies of a nucleic acid sequence.

Amplification is generally carried out using polymerase chain reaction (PCR) technologies well known in the art.

The term "antagonist" refers to a molecule which inhibits or attenuates the biological activity of GCREC. Antagonists may include proteins such as antibodies, nucleic acids, carbohydrates, small
5 molecules, or any other compound or composition which modulates the activity of GCREC either by directly interacting with GCREC or by acting on components of the biological pathway in which GCREC participates.

The term "antibody" refers to intact immunoglobulin molecules as well as to fragments thereof, such as Fab, F(ab')₂, and Fv fragments, which are capable of binding an epitopic determinant.
10 Antibodies that bind GCREC polypeptides can be prepared using intact polypeptides or using fragments containing small peptides of interest as the immunizing antigen. The polypeptide or oligopeptide used to immunize an animal (e.g., a mouse, a rat, or a rabbit) can be derived from the translation of RNA, or synthesized chemically, and can be conjugated to a carrier protein if desired. Commonly used carriers that are chemically coupled to peptides include bovine serum albumin,
15 thyroglobulin, and keyhole limpet hemocyanin (KLH). The coupled peptide is then used to immunize the animal.

The term "antigenic determinant" refers to that region of a molecule (i.e., an epitope) that makes contact with a particular antibody. When a protein or a fragment of a protein is used to immunize a host animal, numerous regions of the protein may induce the production of antibodies
20 which bind specifically to antigenic determinants (particular regions or three-dimensional structures on the protein). An antigenic determinant may compete with the intact antigen (i.e., the immunogen used to elicit the immune response) for binding to an antibody.

The term "antisense" refers to any composition capable of base-pairing with the "sense" (coding) strand of a specific nucleic acid sequence. Antisense compositions may include DNA;
25 RNA; peptide nucleic acid (PNA); oligonucleotides having modified backbone linkages such as phosphorothioates, methylphosphonates, or benzylphosphonates; oligonucleotides having modified sugar groups such as 2'-methoxyethyl sugars or 2'-methoxyethoxy sugars; or oligonucleotides having modified bases such as 5-methyl cytosine, 2'-deoxyuracil, or 7-deaza-2'-deoxyguanosine. Antisense molecules may be produced by any method including chemical synthesis or transcription. Once
30 introduced into a cell, the complementary antisense molecule base-pairs with a naturally occurring nucleic acid sequence produced by the cell to form duplexes which block either transcription or translation. The designation "negative" or "minus" can refer to the antisense strand, and the designation "positive" or "plus" can refer to the sense strand of a reference DNA molecule.

The term "biologically active" refers to a protein having structural, regulatory, or biochemical
35 functions of a naturally occurring molecule. Likewise, "immunologically active" or "immunogenic"

refers to the capability of the natural, recombinant, or synthetic GCREC, or of any oligopeptide thereof, to induce a specific immune response in appropriate animals or cells and to bind with specific antibodies.

“Complementary” describes the relationship between two single-stranded nucleic acid sequences that anneal by base-pairing. For example, 5'-AGT-3' pairs with its complement, 3'-TCA-5'.

A “composition comprising a given polynucleotide sequence” and a “composition comprising a given amino acid sequence” refer broadly to any composition containing the given polynucleotide or amino acid sequence. The composition may comprise a dry formulation or an aqueous solution. Compositions comprising polynucleotide sequences encoding GCREC or fragments of GCREC may be employed as hybridization probes. The probes may be stored in freeze-dried form and may be associated with a stabilizing agent such as a carbohydrate. In hybridizations, the probe may be deployed in an aqueous solution containing salts (e.g., NaCl), detergents (e.g., sodium dodecyl sulfate; SDS), and other components (e.g., Denhardt's solution, dry milk, salmon sperm DNA, etc.).

“Consensus sequence” refers to a nucleic acid sequence which has been subjected to repeated DNA sequence analysis to resolve uncalled bases, extended using the XL-PCR kit (Applied Biosystems, Foster City CA) in the 5' and/or the 3' direction, and resequenced, or which has been assembled from one or more overlapping cDNA, EST, or genomic DNA fragments using a computer program for fragment assembly, such as the GELVIEW fragment assembly system (GCG, Madison WI) or Phrap (University of Washington, Seattle WA). Some sequences have been both extended and assembled to produce the consensus sequence.

“Conservative amino acid substitutions” are those substitutions that are predicted to least interfere with the properties of the original protein, i.e., the structure and especially the function of the protein is conserved and not significantly changed by such substitutions. The table below shows amino acids which may be substituted for an original amino acid in a protein and which are regarded as conservative amino acid substitutions.

	Original Residue	Conservative Substitution
	Ala	Gly, Ser
	Arg	His, Lys
30	Asn	Asp, Gln, His
	Asp	Asn, Glu
	Cys	Ala, Ser
	Gln	Asn, Glu, His
	Glu	Asp, Gln, His
35	Gly	Ala
	His	Asn, Arg, Gln, Glu
	Ile	Leu, Val
	Leu	Ile, Val
	Lys	Arg, Gln, Glu

	Met	Leu, Ile
	Phe	His, Met, Leu, Trp, Tyr
	Ser	Cys, Thr
	Thr	Ser, Val
5	Trp	Phe, Tyr
	Tyr	His, Phe, Trp
	Val	Ile, Leu, Thr

Conservative amino acid substitutions generally maintain (a) the structure of the polypeptide backbone in the area of the substitution, for example, as a beta sheet or alpha helical conformation, (b) the charge or hydrophobicity of the molecule at the site of the substitution, and/or (c) the bulk of the side chain.

A "deletion" refers to a change in the amino acid or nucleotide sequence that results in the absence of one or more amino acid residues or nucleotides.

The term "derivative" refers to a chemically modified polynucleotide or polypeptide. Chemical modifications of a polynucleotide can include, for example, replacement of hydrogen by an alkyl, acyl, hydroxyl, or amino group. A derivative polynucleotide encodes a polypeptide which retains at least one biological or immunological function of the natural molecule. A derivative polypeptide is one modified by glycosylation, pegylation, or any similar process that retains at least one biological or immunological function of the polypeptide from which it was derived.

A "detectable label" refers to a reporter molecule or enzyme that is capable of generating a measurable signal and is covalently or noncovalently joined to a polynucleotide or polypeptide.

"Differential expression" refers to increased or upregulated; or decreased, downregulated, or absent gene or protein expression, determined by comparing at least two different samples. Such comparisons may be carried out between, for example, a treated and an untreated sample, or a diseased and a normal sample.

A "fragment" is a unique portion of GCREC or the polynucleotide encoding GCREC which is identical in sequence to but shorter in length than the parent sequence. A fragment may comprise up to the entire length of the defined sequence, minus one nucleotide/amino acid residue. For example, a fragment may comprise from 5 to 1000 contiguous nucleotides or amino acid residues. A fragment used as a probe, primer, antigen, therapeutic molecule, or for other purposes, may be at least 5, 10, 15, 16, 20, 25, 30, 40, 50, 60, 75, 100, 150, 250 or at least 500 contiguous nucleotides or amino acid residues in length. Fragments may be preferentially selected from certain regions of a molecule. For example, a polypeptide fragment may comprise a certain length of contiguous amino acids selected from the first 250 or 500 amino acids (or first 25% or 50%) of a polypeptide as shown in a certain defined sequence. Clearly these lengths are exemplary, and any length that is supported by the specification, including the Sequence Listing, tables, and figures, may be encompassed by the present

embodiments.

A fragment of SEQ ID NO:24-46 comprises a region of unique polynucleotide sequence that specifically identifies SEQ ID NO:24-46, for example, as distinct from any other sequence in the genome from which the fragment was obtained. A fragment of SEQ ID NO:24-46 is useful, for example, in hybridization and amplification technologies and in analogous methods that distinguish SEQ ID NO:24-46 from related polynucleotide sequences. The precise length of a fragment of SEQ ID NO:24-46 and the region of SEQ ID NO:24-46 to which the fragment corresponds are routinely determinable by one of ordinary skill in the art based on the intended purpose for the fragment.

A fragment of SEQ ID NO:1-23 is encoded by a fragment of SEQ ID NO:24-46. A fragment of SEQ ID NO:1-23 comprises a region of unique amino acid sequence that specifically identifies SEQ ID NO:1-23. For example, a fragment of SEQ ID NO:1-23 is useful as an immunogenic peptide for the development of antibodies that specifically recognize SEQ ID NO:1-23. The precise length of a fragment of SEQ ID NO:1-23 and the region of SEQ ID NO:1-23 to which the fragment corresponds are routinely determinable by one of ordinary skill in the art based on the intended purpose for the fragment.

A "full length" polynucleotide sequence is one containing at least a translation initiation codon (e.g., methionine) followed by an open reading frame and a translation termination codon. A "full length" polynucleotide sequence encodes a "full length" polypeptide sequence.

"Homology" refers to sequence similarity or, interchangeably, sequence identity, between two or more polynucleotide sequences or two or more polypeptide sequences.

The terms "percent identity" and "% identity," as applied to polynucleotide sequences, refer to the percentage of residue matches between at least two polynucleotide sequences aligned using a standardized algorithm. Such an algorithm may insert, in a standardized and reproducible way, gaps in the sequences being compared in order to optimize alignment between two sequences, and therefore achieve a more meaningful comparison of the two sequences.

Percent identity between polynucleotide sequences may be determined using the default parameters of the CLUSTAL V algorithm as incorporated into the MEGALIGN version 3.12e sequence alignment program. This program is part of the LASERGENE software package, a suite of molecular biological analysis programs (DNASTAR, Madison WI). CLUSTAL V is described in Higgins, D.G. and P.M. Sharp (1989) CABIOS 5:151-153 and in Higgins, D.G. et al. (1992) CABIOS 8:189-191. For pairwise alignments of polynucleotide sequences, the default parameters are set as follows: Ktuple=2, gap penalty=5, window=4, and "diagonals saved"=4. The "weighted" residue weight table is selected as the default. Percent identity is reported by CLUSTAL V as the "percent similarity" between aligned polynucleotide sequences.

Alternatively, a suite of commonly used and freely available sequence comparison algorithms

is provided by the National Center for Biotechnology Information (NCBI) Basic Local Alignment Search Tool (BLAST) (Altschul, S.F. et al. (1990) J. Mol. Biol. 215:403-410), which is available from several sources, including the NCBI, Bethesda, MD, and on the Internet at <http://www.ncbi.nlm.nih.gov/BLAST/>. The BLAST software suite includes various sequence

5 analysis programs including "blastn," that is used to align a known polynucleotide sequence with other polynucleotide sequences from a variety of databases. Also available is a tool called "BLAST 2 Sequences" that is used for direct pairwise comparison of two nucleotide sequences. "BLAST 2 Sequences" can be accessed and used interactively at <http://www.ncbi.nlm.nih.gov/gorf/bl2.html>. The "BLAST 2 Sequences" tool can be used for both blastn and blastp (discussed below). BLAST
10 programs are commonly used with gap and other parameters set to default settings. For example, to compare two nucleotide sequences, one may use blastn with the "BLAST 2 Sequences" tool Version 2.0.12 (April-21-2000) set at default parameters. Such default parameters may be, for example:

Matrix: BLOSUM62

Reward for match: 1

15 *Penalty for mismatch: -2*

Open Gap: 5 and Extension Gap: 2 penalties

Gap x drop-off: 50

Expect: 10

Word Size: 11

20 *Filter: on*

Percent identity may be measured over the length of an entire defined sequence, for example, as defined by a particular SEQ ID number, or may be measured over a shorter length, for example, over the length of a fragment taken from a larger, defined sequence, for instance, a fragment of at least 20, at least 30, at least 40, at least 50, at least 70, at least 100, or at least 200 contiguous
25 nucleotides. Such lengths are exemplary only, and it is understood that any fragment length supported by the sequences shown herein, in the tables, figures, or Sequence Listing, may be used to describe a length over which percentage identity may be measured.

Nucleic acid sequences that do not show a high degree of identity may nevertheless encode similar amino acid sequences due to the degeneracy of the genetic code. It is understood that changes
30 in a nucleic acid sequence can be made using this degeneracy to produce multiple nucleic acid sequences that all encode substantially the same protein.

The phrases "percent identity" and "% identity," as applied to polypeptide sequences, refer to the percentage of residue matches between at least two polypeptide sequences aligned using a standardized algorithm. Methods of polypeptide sequence alignment are well-known. Some
35 alignment methods take into account conservative amino acid substitutions. Such conservative

substitutions, explained in more detail above, generally preserve the charge and hydrophobicity at the site of substitution, thus preserving the structure (and therefore function) of the polypeptide.

Percent identity between polypeptide sequences may be determined using the default parameters of the CLUSTAL V algorithm as incorporated into the MEGALIGN version 3.12e sequence alignment program (described and referenced above). For pairwise alignments of polypeptide sequences using CLUSTAL V, the default parameters are set as follows: Ktuple=1, gap penalty=3, window=5, and "diagonals saved"=5. The PAM250 matrix is selected as the default residue weight table. As with polynucleotide alignments, the percent identity is reported by CLUSTAL V as the "percent similarity" between aligned polypeptide sequence pairs.

Alternatively the NCBI BLAST software suite may be used. For example, for a pairwise comparison of two polypeptide sequences, one may use the "BLAST 2 Sequences" tool Version 2.0.12 (April-21-2000) with blastp set at default parameters. Such default parameters may be, for example:

Matrix: BLOSUM62

Open Gap: 11 and Extension Gap: 1 penalties

Gap x drop-off: 50

Expect: 10

Word Size: 3

Filter: on

Percent identity may be measured over the length of an entire defined polypeptide sequence, for example, as defined by a particular SEQ ID number, or may be measured over a shorter length, for example, over the length of a fragment taken from a larger, defined polypeptide sequence, for instance, a fragment of at least 15, at least 20, at least 30, at least 40, at least 50, at least 70 or at least 150 contiguous residues. Such lengths are exemplary only, and it is understood that any fragment length supported by the sequences shown herein, in the tables, figures or Sequence Listing, may be used to describe a length over which percentage identity may be measured.

"Human artificial chromosomes" (HACs) are linear microchromosomes which may contain DNA sequences of about 6 kb to 10 Mb in size and which contain all of the elements required for chromosome replication, segregation and maintenance.

The term "humanized antibody" refers to an antibody molecule in which the amino acid sequence in the non-antigen binding regions has been altered so that the antibody more closely resembles a human antibody, and still retains its original binding ability.

"Hybridization" refers to the process by which a polynucleotide strand anneals with a complementary strand through base pairing under defined hybridization conditions. Specific hybridization is an indication that two nucleic acid sequences share a high degree of complementarity.

Specific hybridization complexes form under permissive annealing conditions and remain hybridized after the "washing" step(s). The washing step(s) is particularly important in determining the stringency of the hybridization process, with more stringent conditions allowing less non-specific binding, i.e., binding between pairs of nucleic acid strands that are not perfectly matched. Permissive conditions for annealing of nucleic acid sequences are routinely determinable by one of ordinary skill in the art and may be consistent among hybridization experiments, whereas wash conditions may be varied among experiments to achieve the desired stringency, and therefore hybridization specificity. Permissive annealing conditions occur, for example, at 68°C in the presence of about 6 x SSC, about 1% (w/v) SDS, and about 100 µg/ml sheared, denatured salmon sperm DNA.

Generally, stringency of hybridization is expressed, in part, with reference to the temperature under which the wash step is carried out. Such wash temperatures are typically selected to be about 5°C to 20°C lower than the thermal melting point (T_m) for the specific sequence at a defined ionic strength and pH. The T_m is the temperature (under defined ionic strength and pH) at which 50% of the target sequence hybridizes to a perfectly matched probe. An equation for calculating T_m and conditions for nucleic acid hybridization are well known and can be found in Sambrook, J. et al. (1989) Molecular Cloning: A Laboratory Manual, 2nd ed., vol. 1-3, Cold Spring Harbor Press, Plainview NY; specifically see volume 2, chapter 9.

High stringency conditions for hybridization between polynucleotides of the present invention include wash conditions of 68°C in the presence of about 0.2 x SSC and about 0.1% SDS, for 1 hour. Alternatively, temperatures of about 65°C, 60°C, 55°C, or 42°C may be used. SSC concentration may be varied from about 0.1 to 2 x SSC, with SDS being present at about 0.1%. Typically, blocking reagents are used to block non-specific hybridization. Such blocking reagents include, for instance, sheared and denatured salmon sperm DNA at about 100-200 µg/ml. Organic solvent, such as formamide at a concentration of about 35-50% v/v, may also be used under particular circumstances, such as for RNA:DNA hybridizations. Useful variations on these wash conditions will be readily apparent to those of ordinary skill in the art. Hybridization, particularly under high stringency conditions, may be suggestive of evolutionary similarity between the nucleotides. Such similarity is strongly indicative of a similar role for the nucleotides and their encoded polypeptides.

The term "hybridization complex" refers to a complex formed between two nucleic acid sequences by virtue of the formation of hydrogen bonds between complementary bases. A hybridization complex may be formed in solution (e.g., C_0t or R_0t analysis) or formed between one nucleic acid sequence present in solution and another nucleic acid sequence immobilized on a solid support (e.g., paper, membranes, filters, chips, pins or glass slides, or any other appropriate substrate to which cells or their nucleic acids have been fixed).

The words "insertion" and "addition" refer to changes in an amino acid or nucleotide

sequence resulting in the addition of one or more amino acid residues or nucleotides, respectively.

“Immune response” can refer to conditions associated with inflammation, trauma, immune disorders, or infectious or genetic disease, etc. These conditions can be characterized by expression of various factors, e.g., cytokines, chemokines, and other signaling molecules, which may affect cellular and systemic defense systems.

An “immunogenic fragment” is a polypeptide or oligopeptide fragment of GCREC which is capable of eliciting an immune response when introduced into a living organism, for example, a mammal. The term “immunogenic fragment” also includes any polypeptide or oligopeptide fragment of GCREC which is useful in any of the antibody production methods disclosed herein or known in the art.

The term “microarray” refers to an arrangement of a plurality of polynucleotides, polypeptides, or other chemical compounds on a substrate.

The terms “element” and “array element” refer to a polynucleotide, polypeptide, or other chemical compound having a unique and defined position on a microarray.

The term “modulate” refers to a change in the activity of GCREC. For example, modulation may cause an increase or a decrease in protein activity, binding characteristics, or any other biological, functional, or immunological properties of GCREC.

The phrases “nucleic acid” and “nucleic acid sequence” refer to a nucleotide, oligonucleotide, polynucleotide, or any fragment thereof. These phrases also refer to DNA or RNA of genomic or synthetic origin which may be single-stranded or double-stranded and may represent the sense or the antisense strand, to peptide nucleic acid (PNA), or to any DNA-like or RNA-like material.

“Operably linked” refers to the situation in which a first nucleic acid sequence is placed in a functional relationship with a second nucleic acid sequence. For instance, a promoter is operably linked to a coding sequence if the promoter affects the transcription or expression of the coding sequence. Operably linked DNA sequences may be in close proximity or contiguous and, where necessary to join two protein coding regions, in the same reading frame.

“Peptide nucleic acid” (PNA) refers to an antisense molecule or anti-gene agent which comprises an oligonucleotide of at least about 5 nucleotides in length linked to a peptide backbone of amino acid residues ending in lysine. The terminal lysine confers solubility to the composition. PNAs preferentially bind complementary single stranded DNA or RNA and stop transcript elongation, and may be pegylated to extend their lifespan in the cell.

“Post-translational modification” of an GCREC may involve lipidation, glycosylation, phosphorylation, acetylation, racemization, proteolytic cleavage, and other modifications known in the art. These processes may occur synthetically or biochemically. Biochemical modifications will vary by cell type depending on the enzymatic milieu of GCREC.

"Probe" refers to nucleic acid sequences encoding GCREC, their complements, or fragments thereof, which are used to detect identical, allelic or related nucleic acid sequences. Probes are isolated oligonucleotides or polynucleotides attached to a detectable label or reporter molecule. Typical labels include radioactive isotopes, ligands, chemiluminescent agents, and enzymes.

- 5 "Primers" are short nucleic acids, usually DNA oligonucleotides, which may be annealed to a target polynucleotide by complementary base-pairing. The primer may then be extended along the target DNA strand by a DNA polymerase enzyme. Primer pairs can be used for amplification (and identification) of a nucleic acid sequence, e.g., by the polymerase chain reaction (PCR).

10 Probes and primers as used in the present invention typically comprise at least 15 contiguous nucleotides of a known sequence. In order to enhance specificity, longer probes and primers may also be employed, such as probes and primers that comprise at least 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, or at least 150 consecutive nucleotides of the disclosed nucleic acid sequences. Probes and primers may be considerably longer than these examples, and it is understood that any length supported by the specification, including the tables, figures, and Sequence Listing, may be used.

- 15 Methods for preparing and using probes and primers are described in the references, for example Sambrook, J. et al. (1989) Molecular Cloning: A Laboratory Manual, 2nd ed., vol. 1-3, Cold Spring Harbor Press, Plainview NY; Ausubel, F.M. et al. (1987) Current Protocols in Molecular Biology, Greene Publ. Assoc. & Wiley-Intersciences, New York NY; Innis, M. et al. (1990) PCR Protocols, A Guide to Methods and Applications, Academic Press, San Diego CA. PCR primer pairs
20 can be derived from a known sequence, for example, by using computer programs intended for that purpose such as Primer (Version 0.5, 1991, Whitehead Institute for Biomedical Research, Cambridge MA).

- Oligonucleotides for use as primers are selected using software known in the art for such purpose. For example, OLIGO 4.06 software is useful for the selection of PCR primer pairs of up to
25 100 nucleotides each, and for the analysis of oligonucleotides and larger polynucleotides of up to 5,000 nucleotides from an input polynucleotide sequence of up to 32 kilobases. Similar primer selection programs have incorporated additional features for expanded capabilities. For example, the PrimOU primer selection program (available to the public from the Genome Center at University of Texas South West Medical Center, Dallas TX) is capable of choosing specific primers from
30 megabase sequences and is thus useful for designing primers on a genome-wide scope. The Primer3 primer selection program (available to the public from the Whitehead Institute/MIT Center for Genome Research, Cambridge MA) allows the user to input a "mispriming library," in which sequences to avoid as primer binding sites are user-specified. Primer3 is useful, in particular, for the selection of oligonucleotides for microarrays. (The source code for the latter two primer selection
35 programs may also be obtained from their respective sources and modified to meet the user's specific

needs.) The PrimeGen program (available to the public from the UK Human Genome Mapping Project Resource Centre, Cambridge UK) designs primers based on multiple sequence alignments, thereby allowing selection of primers that hybridize to either the most conserved or least conserved regions of aligned nucleic acid sequences. Hence, this program is useful for identification of both
5 unique and conserved oligonucleotides and polynucleotide fragments. The oligonucleotides and polynucleotide fragments identified by any of the above selection methods are useful in hybridization technologies, for example, as PCR or sequencing primers, microarray elements, or specific probes to identify fully or partially complementary polynucleotides in a sample of nucleic acids. Methods of oligonucleotide selection are not limited to those described above.

10 A "recombinant nucleic acid" is a sequence that is not naturally occurring or has a sequence that is made by an artificial combination of two or more otherwise separated segments of sequence. This artificial combination is often accomplished by chemical synthesis or, more commonly, by the artificial manipulation of isolated segments of nucleic acids, e.g., by genetic engineering techniques such as those described in Sambrook, supra. The term recombinant includes nucleic acids that have
15 been altered solely by addition, substitution, or deletion of a portion of the nucleic acid. Frequently, a recombinant nucleic acid may include a nucleic acid sequence operably linked to a promoter sequence. Such a recombinant nucleic acid may be part of a vector that is used, for example, to transform a cell.

Alternatively, such recombinant nucleic acids may be part of a viral vector, e.g., based on a
20 vaccinia virus, that could be used to vaccinate a mammal wherein the recombinant nucleic acid is expressed, inducing a protective immunological response in the mammal.

A "regulatory element" refers to a nucleic acid sequence usually derived from untranslated regions of a gene and includes enhancers, promoters, introns, and 5' and 3' untranslated regions (UTRs). Regulatory elements interact with host or viral proteins which control transcription,
25 translation, or RNA stability.

"Reporter molecules" are chemical or biochemical moieties used for labeling a nucleic acid.

cell, chromosome, organelle, or membrane isolated from a cell; a cell; genomic DNA, RNA, or cDNA, in solution or bound to a substrate; a tissue; a tissue print; etc.

The terms "specific binding" and "specifically binding" refer to that interaction between a protein or peptide and an agonist, an antibody, an antagonist, a small molecule, or any natural or synthetic binding composition. The interaction is dependent upon the presence of a particular structure of the protein, e.g., the antigenic determinant or epitope, recognized by the binding molecule. For example, if an antibody is specific for epitope "A," the presence of a polypeptide comprising the epitope A, or the presence of free unlabeled A, in a reaction containing free labeled A and the antibody will reduce the amount of labeled A that binds to the antibody.

10 The term "substantially purified" refers to nucleic acid or amino acid sequences that are removed from their natural environment and are isolated or separated, and are at least 60% free, preferably at least 75% free, and most preferably at least 90% free from other components with which they are naturally associated.

A "substitution" refers to the replacement of one or more amino acid residues or nucleotides by different amino acid residues or nucleotides, respectively.

"Substrate" refers to any suitable rigid or semi-rigid support including membranes, filters, chips, slides, wafers, fibers, magnetic or nonmagnetic beads, gels, tubing, plates, polymers, microparticles and capillaries. The substrate can have a variety of surface forms, such as wells, trenches, pins, channels and pores, to which polynucleotides or polypeptides are bound.

20 A "transcript image" refers to the collective pattern of gene expression by a particular cell type or tissue under given conditions at a given time.

"Transformation" describes a process by which exogenous DNA is introduced into a recipient cell. Transformation may occur under natural or artificial conditions according to various methods well known in the art, and may rely on any known method for the insertion of foreign nucleic acid sequences into a prokaryotic or eukaryotic host cell. The method for transformation is selected based on the type of host cell being transformed and may include, but is not limited to, bacteriophage or viral infection, electroporation, heat shock, lipofection, and particle bombardment. The term "transformed cells" includes stably transformed cells in which the inserted DNA is capable of replication either as an autonomously replicating plasmid or as part of the host chromosome, as well as transiently transformed cells which express the inserted DNA or RNA for limited periods of time.

30 A "transgenic organism," as used herein, is any organism, including but not limited to animals and plants, in which one or more of the cells of the organism contains heterologous nucleic acid introduced by way of human intervention, such as by transgenic techniques well known in the art. The nucleic acid is introduced into the cell, directly or indirectly by introduction into a precursor of the cell, by way of deliberate genetic manipulation, such as by microinjection or by infection with

a recombinant virus. The term genetic manipulation does not include classical cross-breeding, or in vitro fertilization, but rather is directed to the introduction of a recombinant DNA molecule. The transgenic organisms contemplated in accordance with the present invention include bacteria, cyanobacteria, fungi, plants and animals. The isolated DNA of the present invention can be introduced into the host by methods known in the art, for example infection, transfection, transformation or transconjugation. Techniques for transferring the DNA of the present invention into such organisms are widely known and provided in references such as Sambrook et al. (1989), supra.

A "variant" of a particular nucleic acid sequence is defined as a nucleic acid sequence having at least 40% sequence identity to the particular nucleic acid sequence over a certain length of one of the nucleic acid sequences using blastn with the "BLAST 2 Sequences" tool Version 2.0.9 (May-07-1999) set at default parameters. Such a pair of nucleic acids may show, for example, at least 50%, at least 60%, at least 70%, at least 80%, at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% or greater sequence identity over a certain defined length. A variant may be described as, for example, an "allelic" (as defined above), "splice," "species," or "polymorphic" variant. A splice variant may have significant identity to a reference molecule, but will generally have a greater or lesser number of polynucleotides due to alternative splicing of exons during mRNA processing. The corresponding polypeptide may possess additional functional domains or lack domains that are present in the reference molecule. Species variants are polynucleotide sequences that vary from one species to another. The resulting polypeptides will generally have significant amino acid identity relative to each other. A polymorphic variant is a variation in the polynucleotide sequence of a particular gene between individuals of a given species. Polymorphic variants also may encompass "single nucleotide polymorphisms" (SNPs) in which the polynucleotide sequence varies by one nucleotide base. The presence of SNPs may be indicative of, for example, a certain population, a disease state, or a propensity for a disease state.

A "variant" of a particular polypeptide sequence is defined as a polypeptide sequence having at least 40% sequence identity to the particular polypeptide sequence over a certain length of one of the polypeptide sequences using blastp with the "BLAST 2 Sequences" tool Version 2.0.9 (May-07-1999) set at default parameters. Such a pair of polypeptides may show, for example, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% or greater sequence identity over a certain defined length of one of the polypeptides.

35 THE INVENTION

The invention is based on the discovery of new human G-protein coupled receptors (GCREC), the polynucleotides encoding GCREC, and the use of these compositions for the diagnosis, treatment, or prevention of cell proliferative, neurological, cardiovascular, gastrointestinal, autoimmune/inflammatory, and metabolic disorders, and viral infections.

5 Table 1 summarizes the nomenclature for the full length polynucleotide and polypeptide sequences of the invention. Each polynucleotide and its corresponding polypeptide are correlated to a single Incyte project identification number (Incyte Project ID). Each polypeptide sequence is denoted by both a polypeptide sequence identification number (Polypeptide SEQ ID NO:) and an Incyte polypeptide sequence number (Incyte Polypeptide ID) as shown. Each polynucleotide sequence is
10 denoted by both a polynucleotide sequence identification number (Polynucleotide SEQ ID NO:) and an Incyte polynucleotide consensus sequence number (Incyte Polynucleotide ID) as shown.

Table 2 shows sequences with homology to the polypeptides of the invention as identified by BLAST analysis against the GenBank protein (genpept) database. Columns 1 and 2 show the polypeptide sequence identification number (Polypeptide SEQ ID NO:) and the corresponding Incyte
15 polypeptide sequence number (Incyte Polypeptide ID) for polypeptides of the invention. Column 3 shows the GenBank identification number (Genbank ID NO:) of the nearest GenBank homolog. Column 4 shows the probability score for the match between each polypeptide and its GenBank homolog. Column 5 shows the annotation of the GenBank homolog along with relevant citations where applicable, all of which are expressly incorporated by reference herein.

20 Table 3 shows various structural features of the polypeptides of the invention. Columns 1 and 2 show the polypeptide sequence identification number (SEQ ID NO:) and the corresponding Incyte polypeptide sequence number (Incyte Polypeptide ID) for each polypeptide of the invention. Column 3 shows the number of amino acid residues in each polypeptide. Column 4 shows potential phosphorylation sites, and column 5 shows potential glycosylation sites, as determined by the
25 MOTIFS program of the GCG sequence analysis software package (Genetics Computer Group, Madison WI). Column 6 shows amino acid residues comprising signature sequences, domains, and motifs. Column 7 shows analytical methods for protein structure/function analysis and in some cases, searchable databases to which the analytical methods were applied.

Together, Tables 2 and 3 summarize the properties of polypeptides of the invention, and these
30 properties establish that the claimed polypeptides are G-protein coupled receptors. For example, SEQ ID NO:2 is 59% identical to rat taste bud receptor protein (GenBank ID g1256389) as determined by the Basic Local Alignment Search Tool (BLAST). (See Table 2.) The BLAST probability score is $5.7e-95$, which indicates the probability of obtaining the observed polypeptide sequence alignment by chance. SEQ ID NO:2 also contains a seven transmembrane receptor (rhodopsin family) domain as
35 determined by searching for statistically significant matches in the hidden Markov model (HMM)-

based PFAM database of conserved protein family domains. The score is 146.3 and the probability value is $2.2e-45$. (See Table 3.) In addition, SEQ ID NO:2 contains G-protein coupled receptor signatures as determined by BLIMPS analysis of the BLOCKS (BL00237) and PRINTS (PR00237) databases, and by ProfileScan analysis of the Prosite database, as well as an olfactory receptor signature (PR00245) as determined by BLIMPS analysis of the PRINTS database. Based on BLAST, BLIMPS, ProfileScan, and HMM-based analyses, SEQ ID NO:2 is an olfactory G-protein coupled receptor. In an alternative example, SEQ ID NO:15 is 85% identical to murine odorant receptor MOR18 (GenBank ID g6178008) as determined by BLAST. (See Table 2.) The BLAST probability score is $4.6e-138$. SEQ ID NO:15 also contains a seven transmembrane receptor domain as

10 determined by searching for statistically significant matches in the hidden Markov model (HMM)-based PFAM database of conserved protein family domains. Data from BLIMPS, MOTIFS, and PROFILESCAN analyses provide further corroborative evidence that SEQ ID NO:15 is a G-protein coupled receptor. In alternative examples, SEQ ID NO:16 is 72% identical to a mouse olfactory receptor (GenBank ID g3983392) as determined by BLAST analysis, with a probability score of $2.7e-85$; SEQ ID NO:17 is 97% identical to a gorilla olfactory receptor (GenBank ID g7211257), with a probability score of $1.2e-109$; and SEQ ID NO:18 is 51% identical to a canine olfactory receptor (GenBank ID g1314663), with a probability score of $4.1e-82$. (See Table 2.) SEQ ID NO:17 and SEQ ID NO:18 also contain G-protein coupled receptor domains and signature sequences as determined by searching for statistically significant matches in the hidden Markov model (HMM)-

20 based PFAM database of conserved protein family domains. (See Table 3.) Data from BLIMPS, MOTIFS, and PROFILESCAN analyses provide further corroborative evidence that SEQ ID NO:16-18 are G-protein coupled receptors. In an alternative example, SEQ ID NO:19 is 56% identical to mouse odorant receptor S19 (GenBank ID g6532001) as determined by BLAST. (See Table 2.) The BLAST probability score is $1.4e-88$. SEQ ID NO:19 also contains a seven transmembrane receptor (rhodopsin family) domain as determined by searching for statistically significant matches in the

25 hidden Markov model (HMM)-based PFAM database of conserved protein family domains. Data from BLIMPS, MOTIFS, and PROFILESCAN analyses provide further corroborative evidence that SEQ ID NO:19 is a G-protein coupled receptor. SEQ ID NO:1, SEQ ID NO:3-14, and SEQ ID NO:20-23 were analyzed and annotated in a similar manner. The algorithms and parameters for the

30 analysis of SEQ ID NO:1-23 are described in Table 7.

As shown in Table 4, the full length polynucleotide sequences of the present invention were assembled using cDNA sequences or coding (exon) sequences derived from genomic DNA, or any combination of these two types of sequences. Columns 1 and 2 list the polynucleotide sequence identification number (Polynucleotide SEQ ID NO:) and the corresponding Incyte polynucleotide

35 consensus sequence number (Incyte Polynucleotide ID) for each polynucleotide of the invention.

Column 3 shows the length of each polynucleotide sequence in basepairs. Column 4 lists fragments of the polynucleotide sequences which are useful, for example, in hybridization or amplification technologies that identify SEQ ID NO:24-46 or that distinguish between SEQ ID NO:24-46 and related polynucleotide sequences. Column 5 shows identification numbers corresponding to cDNA sequences, coding sequences (exons) predicted from genomic DNA, and/or sequence assemblages comprised of both cDNA and genomic DNA. These sequences were used to assemble the full length polynucleotide sequences of the invention. Columns 6 and 7 of Table 4 show the nucleotide start (5') and stop (3') positions of the cDNA and/or genomic sequences in column 5 relative to their respective full length sequences.

10 The identification numbers in Column 5 of Table 4 may refer specifically, for example, to Incyte cDNAs along with their corresponding cDNA libraries. For example, 7669623H1 is the identification number of an Incyte cDNA sequence, and NOSEDIC02 is the cDNA library from which it is derived. Incyte cDNAs for which cDNA libraries are not indicated were derived from pooled cDNA libraries. Alternatively, the identification numbers in column 5 may refer to GenBank
15 cDNAs or ESTs (e.g., g2525800) which contributed to the assembly of the full length polynucleotide sequences. Alternatively, the identification numbers in column 5 may refer to coding regions predicted by Genscan analysis of genomic DNA. For example, GNN.g7329615_000006_002 is the identification number of a Genscan-predicted coding sequence, with g7329615 being the GenBank identification number of the sequence to which Genscan was applied. The Genscan-predicted coding
20 sequences may have been edited prior to assembly. (See Example IV.) Alternatively, the identification numbers in column 5 may refer to assemblages of both cDNA and Genscan-predicted exons brought together by an "exon stitching" algorithm. (See Example V.) Alternatively, the identification numbers in column 5 may refer to assemblages of both cDNA and Genscan-predicted exons brought together by an "exon-stretching" algorithm. (See Example V.) In some cases, Incyte
25 cDNA coverage redundant with the sequence coverage shown in column 5 was obtained to confirm the final consensus polynucleotide sequence, but the relevant Incyte cDNA identification numbers are not shown.

Table 5 shows the representative cDNA libraries for those full length polynucleotide sequences which were assembled using Incyte cDNA sequences. The representative cDNA library is
30 the Incyte cDNA library which is most frequently represented by the Incyte cDNA sequences which were used to assemble and confirm the above polynucleotide sequences. The tissues and vectors which were used to construct the cDNA libraries shown in Table 5 are described in Table 6.

Table 8 shows tissue-specific expression of polynucleotides of the invention. Column 1 lists groups of tissues which were tested by polymerase chain reaction (PCR) for expression of the
35 polynucleotides. The remaining columns indicate whether a particular polynucleotide was expressed

in each tissue group. Detection of a PCR product indicated positive expression, denoted by a "+" sign, while inability to detect a PCR product indicated a lack of expression, denoted by a "-" sign.

The invention also encompasses GCREC variants. A preferred GCREC variant is one which has at least about 80%, or alternatively at least about 90%, or even at least about 95% amino acid sequence identity to the GCREC amino acid sequence, and which contains at least one functional or structural characteristic of GCREC.

The invention also encompasses polynucleotides which encode GCREC. In a particular embodiment, the invention encompasses a polynucleotide sequence comprising a sequence selected from the group consisting of SEQ ID NO:24-46, which encodes GCREC. The polynucleotide sequences of SEQ ID NO:24-46, as presented in the Sequence Listing, embrace the equivalent RNA sequences, wherein occurrences of the nitrogenous base thymine are replaced with uracil, and the sugar backbone is composed of ribose instead of deoxyribose.

The invention also encompasses a variant of a polynucleotide sequence encoding GCREC. In particular, such a variant polynucleotide sequence will have at least about 70%, or alternatively at least about 85%, or even at least about 95% polynucleotide sequence identity to the polynucleotide sequence encoding GCREC. A particular aspect of the invention encompasses a variant of a polynucleotide sequence comprising a sequence selected from the group consisting of SEQ ID NO:24-46 which has at least about 70%, or alternatively at least about 85%, or even at least about 95% polynucleotide sequence identity to a nucleic acid sequence selected from the group consisting of SEQ ID NO:24-46. Any one of the polynucleotide variants described above can encode an amino acid sequence which contains at least one functional or structural characteristic of GCREC.

It will be appreciated by those skilled in the art that as a result of the degeneracy of the genetic code, a multitude of polynucleotide sequences encoding GCREC, some bearing minimal similarity to the polynucleotide sequences of any known and naturally occurring gene, may be produced. Thus, the invention contemplates each and every possible variation of polynucleotide sequence that could be made by selecting combinations based on possible codon choices. These combinations are made in accordance with the standard triplet genetic code as applied to the polynucleotide sequence of naturally occurring GCREC, and all such variations are to be considered as being specifically disclosed.

Although nucleotide sequences which encode GCREC and its variants are generally capable of hybridizing to the nucleotide sequence of the naturally occurring GCREC under appropriately selected conditions of stringency, it may be advantageous to produce nucleotide sequences encoding GCREC or its derivatives possessing a substantially different codon usage, e.g., inclusion of non-naturally occurring codons. Codons may be selected to increase the rate at which expression of the peptide occurs in a particular prokaryotic or eukaryotic host in accordance with the frequency with

which particular codons are utilized by the host. Other reasons for substantially altering the nucleotide sequence encoding GCREC and its derivatives without altering the encoded amino acid sequences include the production of RNA transcripts having more desirable properties, such as a greater half-life, than transcripts produced from the naturally occurring sequence.

5 The invention also encompasses production of DNA sequences which encode GCREC and GCREC derivatives, or fragments thereof, entirely by synthetic chemistry. After production, the synthetic sequence may be inserted into any of the many available expression vectors and cell systems using reagents well known in the art. Moreover, synthetic chemistry may be used to introduce mutations into a sequence encoding GCREC or any fragment thereof.

10 Also encompassed by the invention are polynucleotide sequences that are capable of hybridizing to the claimed polynucleotide sequences, and, in particular, to those shown in SEQ ID NO:24-46 and fragments thereof under various conditions of stringency. (See, e.g., Wahl, G.M. and S.L. Berger (1987) *Methods Enzymol.* 152:399-407; Kimmel, A.R. (1987) *Methods Enzymol.* 152:507-511.) Hybridization conditions, including annealing and wash conditions, are described in
15 "Definitions."

 Methods for DNA sequencing are well known in the art and may be used to practice any of the embodiments of the invention. The methods may employ such enzymes as the Klenow fragment of DNA polymerase I, SEQUENASE (US Biochemical, Cleveland OH), Taq polymerase (Applied Biosystems), thermostable T7 polymerase (Amersham Pharmacia Biotech, Piscataway NJ), or
20 combinations of polymerases and proofreading exonucleases such as those found in the ELONGASE amplification system (Life Technologies, Gaithersburg MD). Preferably, sequence preparation is automated with machines such as the MICROLAB 2200 liquid transfer system (Hamilton, Reno NV), PTC200 thermal cycler (MJ Research, Watertown MA) and ABI CATALYST 800 thermal cycler (Applied Biosystems). Sequencing is then carried out using either the ABI 373 or 377 DNA
25 sequencing system (Applied Biosystems), the MEGABACE 1000 DNA sequencing system (Molecular Dynamics, Sunnyvale CA), or other systems known in the art. The resulting sequences are analyzed using a variety of algorithms which are well known in the art. (See, e.g., Ausubel, F.M. (1997) Short Protocols in Molecular Biology, John Wiley & Sons, New York NY, unit 7.7; Meyers, R.A. (1995) Molecular Biology and Biotechnology, Wiley VCH, New York NY, pp. 856-853.)

30 The nucleic acid sequences encoding GCREC may be extended utilizing a partial nucleotide sequence and employing various PCR-based methods known in the art to detect upstream sequences, such as promoters and regulatory elements. For example, one method which may be employed, restriction-site PCR, uses universal and nested primers to amplify unknown sequence from genomic DNA within a cloning vector. (See, e.g., Sarkar, G. (1993) *PCR Methods Applic.* 2:318-322.)
35 Another method, inverse PCR, uses primers that extend in divergent directions to amplify unknown

sequence from a circularized template. The template is derived from restriction fragments comprising a known genomic locus and surrounding sequences. (See, e.g., Triglia, T. et al. (1988) *Nucleic Acids Res.* 16:8186.) A third method, capture PCR, involves PCR amplification of DNA fragments adjacent to known sequences in human and yeast artificial chromosome DNA. (See, e.g., Lagerstrom, M. et al. (1991) *PCR Methods Applic.* 1:111-119.) In this method, multiple restriction enzyme digestions and ligations may be used to insert an engineered double-stranded sequence into a region of unknown sequence before performing PCR. Other methods which may be used to retrieve unknown sequences are known in the art. (See, e.g., Parker, J.D. et al. (1991) *Nucleic Acids Res.* 19:3055-3060). Additionally, one may use PCR, nested primers, and PROMOTERFINDER libraries (Clontech, Palo Alto CA) to walk genomic DNA. This procedure avoids the need to screen libraries and is useful in finding intron/exon junctions. For all PCR-based methods, primers may be designed using commercially available software, such as OLIGO 4.06 primer analysis software (National Biosciences, Plymouth MN) or another appropriate program, to be about 22 to 30 nucleotides in length, to have a GC content of about 50% or more, and to anneal to the template at temperatures of about 68°C to 72°C.

When screening for full length cDNAs, it is preferable to use libraries that have been size-selected to include larger cDNAs. In addition, random-primed libraries, which often include sequences containing the 5' regions of genes, are preferable for situations in which an oligo d(T) library does not yield a full-length cDNA. Genomic libraries may be useful for extension of sequence into 5' non-transcribed regulatory regions.

Capillary electrophoresis systems which are commercially available may be used to analyze the size or confirm the nucleotide sequence of sequencing or PCR products. In particular, capillary sequencing may employ flowable polymers for electrophoretic separation, four different nucleotide-specific, laser-stimulated fluorescent dyes, and a charge coupled device camera for detection of the emitted wavelengths. Output/light intensity may be converted to electrical signal using appropriate software (e.g., GENOTYPER and SEQUENCE NAVIGATOR, Applied Biosystems), and the entire process from loading of samples to computer analysis and electronic data display may be computer controlled. Capillary electrophoresis is especially preferable for sequencing small DNA fragments which may be present in limited amounts in a particular sample.

In another embodiment of the invention, polynucleotide sequences or fragments thereof which encode GCREC may be cloned in recombinant DNA molecules that direct expression of GCREC, or fragments or functional equivalents thereof, in appropriate host cells. Due to the inherent degeneracy of the genetic code, other DNA sequences which encode substantially the same or a functionally equivalent amino acid sequence may be produced and used to express GCREC.

The nucleotide sequences of the present invention can be engineered using methods generally

known in the art in order to alter GCREC-encoding sequences for a variety of purposes including, but not limited to, modification of the cloning, processing, and/or expression of the gene product. DNA shuffling by random fragmentation and PCR reassembly of gene fragments and synthetic oligonucleotides may be used to engineer the nucleotide sequences. For example, oligonucleotide-mediated site-directed mutagenesis may be used to introduce mutations that create new restriction sites, alter glycosylation patterns, change codon preference, produce splice variants, and so forth.

The nucleotides of the present invention may be subjected to DNA shuffling techniques such as MOLECULARBREEDING (Maxygen Inc., Santa Clara CA; described in U.S. Patent Number 5,837,458; Chang, C.-C. et al. (1999) Nat. Biotechnol. 17:793-797; Christians, F.C. et al. (1999) Nat. Biotechnol. 17:259-264; and Cramer, A. et al. (1996) Nat. Biotechnol. 14:315-319) to alter or improve the biological properties of GCREC, such as its biological or enzymatic activity or its ability to bind to other molecules or compounds. DNA shuffling is a process by which a library of gene variants is produced using PCR-mediated recombination of gene fragments. The library is then subjected to selection or screening procedures that identify those gene variants with the desired properties. These preferred variants may then be pooled and further subjected to recursive rounds of DNA shuffling and selection/screening. Thus, genetic diversity is created through "artificial" breeding and rapid molecular evolution. For example, fragments of a single gene containing random point mutations may be recombined, screened, and then reshuffled until the desired properties are optimized. Alternatively, fragments of a given gene may be recombined with fragments of homologous genes in the same gene family, either from the same or different species, thereby maximizing the genetic diversity of multiple naturally occurring genes in a directed and controllable manner.

In another embodiment, sequences encoding GCREC may be synthesized, in whole or in part, using chemical methods well known in the art. (See, e.g., Caruthers, M.H. et al. (1980) Nucleic Acids Symp. Ser. 7:215-223; and Horn, T. et al. (1980) Nucleic Acids Symp. Ser. 7:225-232.) Alternatively, GCREC itself or a fragment thereof may be synthesized using chemical methods. For example, peptide synthesis can be performed using various solution-phase or solid-phase techniques. (See, e.g., Creighton, T. (1984) Proteins, Structures and Molecular Properties, WH Freeman, New York NY, pp. 55-60; and Roberge, J.Y. et al. (1995) Science 269:202-204.) Automated synthesis may be achieved using the ABI 431A peptide synthesizer (Applied Biosystems). Additionally, the amino acid sequence of GCREC, or any part thereof, may be altered during direct synthesis and/or combined with sequences from other proteins, or any part thereof, to produce a variant polypeptide or a polypeptide having a sequence of a naturally occurring polypeptide.

The peptide may be substantially purified by preparative high performance liquid chromatography. (See, e.g., Chiez, R.M. and F.Z. Regnier (1990) Methods Enzymol. 182:392-421.)

The composition of the synthetic peptides may be confirmed by amino acid analysis or by sequencing. (See, e.g., Creighton, supra, pp. 28-53.)

In order to express a biologically active GCREC, the nucleotide sequences encoding GCREC or derivatives thereof may be inserted into an appropriate expression vector, i.e., a vector which contains the necessary elements for transcriptional and translational control of the inserted coding sequence in a suitable host. These elements include regulatory sequences, such as enhancers, constitutive and inducible promoters, and 5' and 3' untranslated regions in the vector and in polynucleotide sequences encoding GCREC. Such elements may vary in their strength and specificity. Specific initiation signals may also be used to achieve more efficient translation of sequences encoding GCREC. Such signals include the ATG initiation codon and adjacent sequences, e.g. the Kozak sequence. In cases where sequences encoding GCREC and its initiation codon and upstream regulatory sequences are inserted into the appropriate expression vector, no additional transcriptional or translational control signals may be needed. However, in cases where only coding sequence, or a fragment thereof, is inserted, exogenous translational control signals including an in-frame ATG initiation codon should be provided by the vector. Exogenous translational elements and initiation codons may be of various origins, both natural and synthetic. The efficiency of expression may be enhanced by the inclusion of enhancers appropriate for the particular host cell system used. (See, e.g., Scharf, D. et al. (1994) *Results Probl. Cell Differ.* 20:125-162.)

Methods which are well known to those skilled in the art may be used to construct expression vectors containing sequences encoding GCREC and appropriate transcriptional and translational control elements. These methods include in vitro recombinant DNA techniques, synthetic techniques, and in vivo genetic recombination. (See, e.g., Sambrook, J. et al. (1989) Molecular Cloning, A Laboratory Manual, Cold Spring Harbor Press, Plainview NY, ch. 4, 8, and 16-17; Ausubel, F.M. et al. (1995) Current Protocols in Molecular Biology, John Wiley & Sons, New York NY, ch. 9, 13, and 16.)

A variety of expression vector/host systems may be utilized to contain and express sequences encoding GCREC. These include, but are not limited to, microorganisms such as bacteria transformed with recombinant bacteriophage, plasmid, or cosmid DNA expression vectors; yeast transformed with yeast expression vectors; insect cell systems infected with viral expression vectors (e.g., baculovirus); plant cell systems transformed with viral expression vectors (e.g., cauliflower mosaic virus, CaMV, or tobacco mosaic virus, TMV) or with bacterial expression vectors (e.g., Ti or pBR322 plasmids); or animal cell systems. (See, e.g., Sambrook, supra; Ausubel, supra; Van Heeke, G. and S.M. Schuster (1989) *J. Biol. Chem.* 264:5503-5509; Engelhard, E.K. et al. (1994) *Proc. Natl. Acad. Sci. USA* 91:3224-3227; Sandig, V. et al. (1996) *Hum. Gene Ther.* 7:1937-1945; Takamatsu, N. (1987) *EMBO J.* 6:307-311; The McGraw Hill Yearbook of Science and Technology (1992)

McGraw Hill, New York NY, pp. 191-196; Logan, J. and T. Shenk (1984) Proc. Natl. Acad. Sci. USA 81:3655-3659; and Harrington, J.J. et al. (1997) Nat. Genet. 15:345-355.) Expression vectors derived from retroviruses, adenoviruses, or herpes or vaccinia viruses, or from various bacterial plasmids, may be used for delivery of nucleotide sequences to the targeted organ, tissue, or cell population.

- 5 (See, e.g., Di Nicola, M. et al. (1998) Cancer Gen. Ther. 5(6):350-356; Yu, M. et al. (1993) Proc. Natl. Acad. Sci. USA 90(13):6340-6344; Buller, R.M. et al. (1985) Nature 317(6040):813-815; McGregor, D.P. et al. (1994) Mol. Immunol. 31(3):219-226; and Verma, I.M. and N. Somia (1997) Nature 389:239-242.) The invention is not limited by the host cell employed.

In bacterial systems, a number of cloning and expression vectors may be selected depending upon the use intended for polynucleotide sequences encoding GCREC. For example, routine cloning, subcloning, and propagation of polynucleotide sequences encoding GCREC can be achieved using a multifunctional *E. coli* vector such as PBLUESCRIPT (Stratagene, La Jolla CA) or PSPORT1 plasmid (Life Technologies). Ligation of sequences encoding GCREC into the vector's multiple cloning site disrupts the *lacZ* gene, allowing a colorimetric screening procedure for identification of transformed bacteria containing recombinant molecules. In addition, these vectors may be useful for *in vitro* transcription, dideoxy sequencing, single strand rescue with helper phage, and creation of nested deletions in the cloned sequence. (See, e.g., Van Heeke, G. and S.M. Schuster (1989) J. Biol. Chem. 264:5503-5509.) When large quantities of GCREC are needed, e.g. for the production of antibodies, vectors which direct high level expression of GCREC may be used. For example, vectors containing the strong, inducible SP6 or T7 bacteriophage promoter may be used.

Yeast expression systems may be used for production of GCREC. A number of vectors containing constitutive or inducible promoters, such as alpha factor, alcohol oxidase, and PGH promoters, may be used in the yeast *Saccharomyces cerevisiae* or *Pichia pastoris*. In addition, such vectors direct either the secretion or intracellular retention of expressed proteins and enable integration of foreign sequences into the host genome for stable propagation. (See, e.g., Ausubel, 1995, *supra*; Bitter, G.A. et al. (1987) Methods Enzymol. 153:516-544; and Scorer, C.A. et al. (1994) Bio/Technology 12:181-184.)

Plant systems may also be used for expression of GCREC. Transcription of sequences encoding GCREC may be driven by viral promoters, e.g., the 35S and 19S promoters of CaMV used alone or in combination with the omega leader sequence from TMV (Takamatsu, N. (1987) EMBO J. 6:307-311). Alternatively, plant promoters such as the small subunit of RUBISCO or heat shock promoters may be used. (See, e.g., Coruzzi, G. et al. (1984) EMBO J. 3:1671-1680; Broglie, R. et al. (1984) Science 224:838-843; and Winter, J. et al. (1991) Results Probl. Cell Differ. 17:85-105.) These constructs can be introduced into plant cells by direct DNA transformation or pathogen-mediated transfection. (See, e.g., *The McGraw Hill Yearbook of Science and Technology*

(1992) McGraw Hill, New York NY, pp. 191-196.)

In mammalian cells, a number of viral-based expression systems may be utilized. In cases where an adenovirus is used as an expression vector, sequences encoding GCREC may be ligated into an adenovirus transcription/translation complex consisting of the late promoter and tripartite leader sequence. Insertion in a non-essential E1 or E3 region of the viral genome may be used to obtain infective virus which expresses GCREC in host cells. (See, e.g., Logan, J. and T. Shenk (1984) Proc. Natl. Acad. Sci. USA 81:3655-3659.) In addition, transcription enhancers, such as the Rous sarcoma virus (RSV) enhancer, may be used to increase expression in mammalian host cells. SV40 or EBV-based vectors may also be used for high-level protein expression.

Human artificial chromosomes (HACs) may also be employed to deliver larger fragments of DNA than can be contained in and expressed from a plasmid. HACs of about 6 kb to 10 Mb are constructed and delivered via conventional delivery methods (liposomes, polycationic amino polymers, or vesicles) for therapeutic purposes. (See, e.g., Harrington, J.J. et al. (1997) Nat. Genet. 15:345-355.)

For long term production of recombinant proteins in mammalian systems, stable expression of GCREC in cell lines is preferred. For example, sequences encoding GCREC can be transformed into cell lines using expression vectors which may contain viral origins of replication and/or endogenous expression elements and a selectable marker gene on the same or on a separate vector. Following the introduction of the vector, cells may be allowed to grow for about 1 to 2 days in enriched media before being switched to selective media. The purpose of the selectable marker is to confer resistance to a selective agent, and its presence allows growth and recovery of cells which successfully express the introduced sequences. Resistant clones of stably transformed cells may be propagated using tissue culture techniques appropriate to the cell type.

Any number of selection systems may be used to recover transformed cell lines. These include, but are not limited to, the herpes simplex virus thymidine kinase and adenine phosphoribosyltransferase genes, for use in *tk⁻* and *apr⁻* cells, respectively. (See, e.g., Wigler, M. et al. (1977) Cell 11:223-232; Lowy, I. et al. (1980) Cell 22:817-823.) Also, antimetabolite, antibiotic, or herbicide resistance can be used as the basis for selection. For example, *dhfr* confers resistance to methotrexate; *neo* confers resistance to the aminoglycosides neomycin and G-418; and *als* and *pat* confer resistance to chlorsulfuron and phosphinotricin acetyltransferase, respectively. (See, e.g., Wigler, M. et al. (1980) Proc. Natl. Acad. Sci. USA 77:3567-3570; Colbere-Garapin, F. et al. (1981) J. Mol. Biol. 150:1-14.) Additional selectable genes have been described, e.g., *trpB* and *hisD*, which alter cellular requirements for metabolites. (See, e.g., Hartman, S.C. and R.C. Mulligan (1988) Proc. Natl. Acad. Sci. USA 85:8047-8051.) Visible markers, e.g., anthocyanins, green fluorescent proteins (GFP; Clontech), β glucuronidase and its substrate β -glucuronide, or luciferase and its substrate

luciferin may be used. These markers can be used not only to identify transformants, but also to quantify the amount of transient or stable protein expression attributable to a specific vector system. (See, e.g., Rhodes, C.A. (1995) *Methods Mol. Biol.* 55:121-131.)

Although the presence/absence of marker gene expression suggests that the gene of interest is also present, the presence and expression of the gene may need to be confirmed. For example, if the sequence encoding GCREC is inserted within a marker gene sequence, transformed cells containing sequences encoding GCREC can be identified by the absence of marker gene function. Alternatively, a marker gene can be placed in tandem with a sequence encoding GCREC under the control of a single promoter. Expression of the marker gene in response to induction or selection usually indicates expression of the tandem gene as well.

In general, host cells that contain the nucleic acid sequence encoding GCREC and that express GCREC may be identified by a variety of procedures known to those of skill in the art. These procedures include, but are not limited to, DNA-DNA or DNA-RNA hybridizations, PCR amplification, and protein bioassay or immunoassay techniques which include membrane, solution, or chip based technologies for the detection and/or quantification of nucleic acid or protein sequences.

Immunological methods for detecting and measuring the expression of GCREC using either specific polyclonal or monoclonal antibodies are known in the art. Examples of such techniques include enzyme-linked immunosorbent assays (ELISAs), radioimmunoassays (RIAs), and fluorescence activated cell sorting (FACS). A two-site, monoclonal-based immunoassay utilizing monoclonal antibodies reactive to two non-interfering epitopes on GCREC is preferred, but a competitive binding assay may be employed. These and other assays are well known in the art. (See, e.g., Hampton, R. et al. (1990) Serological Methods, a Laboratory Manual, APS Press, St. Paul MN, Sect. IV; Coligan, J.E. et al. (1997) Current Protocols in Immunology, Greene Pub. Associates and Wiley-Interscience, New York NY; and Pound, J.D. (1998) Immunochemical Protocols, Humana Press, Totowa NJ.)

A wide variety of labels and conjugation techniques are known by those skilled in the art and may be used in various nucleic acid and amino acid assays. Means for producing labeled hybridization or PCR probes for detecting sequences related to polynucleotides encoding GCREC include oligolabeling, nick translation, end-labeling, or PCR amplification using a labeled nucleotide. Alternatively, the sequences encoding GCREC, or any fragments thereof, may be cloned into a vector for the production of an mRNA probe. Such vectors are known in the art, are commercially available, and may be used to synthesize RNA probes *in vitro* by addition of an appropriate RNA polymerase such as T7, T3, or SP6 and labeled nucleotides. These procedures may be conducted using a variety of commercially available kits, such as those provided by Amersham Pharmacia Biotech, Promega (Madison WI), and US Biochemical. Suitable reporter molecules or labels which may be used for

ease of detection include radionuclides, enzymes, fluorescent, chemiluminescent, or chromogenic agents, as well as substrates, cofactors, inhibitors, magnetic particles, and the like.

Host cells transformed with nucleotide sequences encoding GCREC may be cultured under conditions suitable for the expression and recovery of the protein from cell culture. The protein
5 produced by a transformed cell may be secreted or retained intracellularly depending on the sequence and/or the vector used. As will be understood by those of skill in the art, expression vectors containing polynucleotides which encode GCREC may be designed to contain signal sequences which direct secretion of GCREC through a prokaryotic or eukaryotic cell membrane.

In addition, a host cell strain may be chosen for its ability to modulate expression of the
10 inserted sequences or to process the expressed protein in the desired fashion. Such modifications of the polypeptide include, but are not limited to, acetylation, carboxylation, glycosylation, phosphorylation, lipidation, and acylation. Post-translational processing which cleaves a "prepro" or "pro" form of the protein may also be used to specify protein targeting, folding, and/or activity. Different host cells which have specific cellular machinery and characteristic mechanisms for
15 post-translational activities (e.g., CHO, HeLa, MDCK, HEK293, and WI38) are available from the American Type Culture Collection (ATCC, Manassas VA) and may be chosen to ensure the correct modification and processing of the foreign protein.

In another embodiment of the invention, natural, modified, or recombinant nucleic acid sequences encoding GCREC may be ligated to a heterologous sequence resulting in translation of a
20 fusion protein in any of the aforementioned host systems. For example, a chimeric GCREC protein containing a heterologous moiety that can be recognized by a commercially available antibody may facilitate the screening of peptide libraries for inhibitors of GCREC activity. Heterologous protein and peptide moieties may also facilitate purification of fusion proteins using commercially available affinity matrices. Such moieties include, but are not limited to, glutathione S-transferase (GST),
25 maltose binding protein (MBP), thioredoxin (Trx), calmodulin binding peptide (CBP), 6-His, FLAG, *c-myc*, and hemagglutinin (HA). GST, MBP, Trx, CBP, and 6-His enable purification of their cognate fusion proteins on immobilized glutathione, maltose, phenylarsine oxide, calmodulin, and metal-chelate resins, respectively. FLAG, *c-myc*, and hemagglutinin (HA) enable immunoaffinity purification of fusion proteins using commercially available monoclonal and polyclonal antibodies
30 that specifically recognize these epitope tags. A fusion protein may also be engineered to contain a proteolytic cleavage site located between the GCREC encoding sequence and the heterologous protein sequence, so that GCREC may be cleaved away from the heterologous moiety following purification. Methods for fusion protein expression and purification are discussed in Ausubel (1995, supra, ch. 10). A variety of commercially available kits may also be used to facilitate expression and
35 purification of fusion proteins.

In a further embodiment of the invention, synthesis of radiolabeled GCREC may be achieved in vitro using the TNT rabbit reticulocyte lysate or wheat germ extract system (Promega). These systems couple transcription and translation of protein-coding sequences operably associated with the T7, T3, or SP6 promoters. Translation takes place in the presence of a radiolabeled amino acid precursor, for example, ³⁵S-methionine.

GCREC of the present invention or fragments thereof may be used to screen for compounds that specifically bind to GCREC. At least one and up to a plurality of test compounds may be screened for specific binding to GCREC. Examples of test compounds include antibodies, oligonucleotides, proteins (e.g., receptors), or small molecules.

In one embodiment, the compound thus identified is closely related to the natural ligand of GCREC, e.g., a ligand or fragment thereof, a natural substrate, a structural or functional mimetic, or a natural binding partner. (See, e.g., Coligan, J.E. et al. (1991) Current Protocols in Immunology 1(2): Chapter 5.) Similarly, the compound can be closely related to the natural receptor to which GCREC binds, or to at least a fragment of the receptor, e.g., the ligand binding site. In either case, the compound can be rationally designed using known techniques. In one embodiment, screening for these compounds involves producing appropriate cells which express GCREC, either as a secreted protein or on the cell membrane. Preferred cells include cells from mammals, yeast, Drosophila, or E. coli. Cells expressing GCREC or cell membrane fractions which contain GCREC are then contacted with a test compound and binding, stimulation, or inhibition of activity of either GCREC or the compound is analyzed.

An assay may simply test binding of a test compound to the polypeptide, wherein binding is detected by a fluorophore, radioisotope, enzyme conjugate, or other detectable label. For example, the assay may comprise the steps of combining at least one test compound with GCREC, either in solution or affixed to a solid support, and detecting the binding of GCREC to the compound. Alternatively, the assay may detect or measure binding of a test compound in the presence of a labeled competitor. Additionally, the assay may be carried out using cell-free preparations, chemical libraries, or natural product mixtures, and the test compound(s) may be free in solution or affixed to a solid support.

GCREC of the present invention or fragments thereof may be used to screen for compounds that modulate the activity of GCREC. Such compounds may include agonists, antagonists, or partial or inverse agonists. In one embodiment, an assay is performed under conditions permissive for GCREC activity, wherein GCREC is combined with at least one test compound, and the activity of GCREC in the presence of a test compound is compared with the activity of GCREC in the absence of the test compound. A change in the activity of GCREC in the presence of the test compound is indicative of a compound that modulates the activity of GCREC. Alternatively, a test compound is

combined with an in vitro or cell-free system comprising GCREC under conditions suitable for GCREC activity, and the assay is performed. In either of these assays, a test compound which modulates the activity of GCREC may do so indirectly and need not come in direct contact with the test compound. At least one and up to a plurality of test compounds may be screened.

5 In another embodiment, polynucleotides encoding GCREC or their mammalian homologs may be "knocked out" in an animal model system using homologous recombination in embryonic stem (ES) cells. Such techniques are well known in the art and are useful for the generation of animal models of human disease. (See, e.g., U.S. Patent Number 5,175,383 and U.S. Patent Number 5,767,337.) For example, mouse ES cells, such as the mouse 129/SvJ cell line, are derived from the
10 early mouse embryo and grown in culture. The ES cells are transformed with a vector containing the gene of interest disrupted by a marker gene, e.g., the neomycin phosphotransferase gene (neo; Capecchi, M.R. (1989) Science 244:1288-1292). The vector integrates into the corresponding region of the host genome by homologous recombination. Alternatively, homologous recombination takes place using the Cre-loxP system to knockout a gene of interest in a tissue- or developmental stage-
15 specific manner (Marth, J.D. (1996) Clin. Invest. 97:1999-2002; Wagner, K.U. et al. (1997) Nucleic Acids Res. 25:4323-4330). Transformed ES cells are identified and microinjected into mouse cell blastocysts such as those from the C57BL/6 mouse strain. The blastocysts are surgically transferred to pseudopregnant dams, and the resulting chimeric progeny are genotyped and bred to produce heterozygous or homozygous strains. Transgenic animals thus generated may be tested with potential
20 therapeutic or toxic agents.

Polynucleotides encoding GCREC may also be manipulated in vitro in ES cells derived from human blastocysts. Human ES cells have the potential to differentiate into at least eight separate cell lineages including endoderm, mesoderm, and ectodermal cell types. These cell lineages differentiate into, for example, neural cells, hematopoietic lineages, and cardiomyocytes (Thomson, J.A. et al.
25 (1998) Science 282:1145-1147).

Polynucleotides encoding GCREC can also be used to create "knockin" humanized animals (pigs) or transgenic animals (mice or rats) to model human disease. With knockin technology, a region of a polynucleotide encoding GCREC is injected into animal ES cells, and the injected sequence integrates into the animal cell genome. Transformed cells are injected into blastulae, and
30 the blastulae are implanted as described above. Transgenic progeny or inbred lines are studied and treated with potential pharmaceutical agents to obtain information on treatment of a human disease. Alternatively, a mammal inbred to overexpress GCREC, e.g., by secreting GCREC in its milk, may also serve as a convenient source of that protein (Janne, J. et al. (1998) Biotechnol. Annu. Rev. 4:55-74).

35 **THERAPEUTICS**

Chemical and structural similarity, e.g., in the context of sequences and motifs, exists between regions of GCREC and G-protein coupled receptors. In addition, the expression of GCREC is closely associated with nasal polyp tissue. Therefore, GCREC appears to play a role in cell proliferative, neurological, cardiovascular, gastrointestinal, autoimmune/inflammatory, and metabolic disorders, and viral infections. In the treatment of disorders associated with increased GCREC expression or activity, it is desirable to decrease the expression or activity of GCREC. In the treatment of disorders associated with decreased GCREC expression or activity, it is desirable to increase the expression or activity of GCREC.

Therefore, in one embodiment, GCREC or a fragment or derivative thereof may be administered to a subject to treat or prevent a disorder associated with decreased expression or activity of GCREC. Examples of such disorders include, but are not limited to, a cell proliferative disorder such as actinic keratosis, arteriosclerosis, atherosclerosis, bursitis, cirrhosis, hepatitis, mixed connective tissue disease (MCTD), myelofibrosis, paroxysmal nocturnal hemoglobinuria, polycythemia vera, psoriasis, primary thrombocythemia, and cancers including adenocarcinoma, leukemia, lymphoma, melanoma, myeloma, sarcoma, teratocarcinoma, and, in particular, cancers of the adrenal gland, bladder, bone, bone marrow, brain, breast, cervix, gall bladder, ganglia, gastrointestinal tract, heart, kidney, liver, lung, muscle, ovary, pancreas, parathyroid, penis, prostate, salivary glands, skin, spleen, testis, thymus, thyroid, and uterus; a neurological disorder such as epilepsy, ischemic cerebrovascular disease, stroke, cerebral neoplasms, Alzheimer's disease, Pick's disease, Huntington's disease, dementia, Parkinson's disease and other extrapyramidal disorders, amyotrophic lateral sclerosis and other motor neuron disorders, progressive neural muscular atrophy, retinitis pigmentosa, hereditary ataxias, multiple sclerosis and other demyelinating diseases, bacterial and viral meningitis, brain abscess, subdural empyema, epidural abscess, suppurative intracranial thrombophlebitis, myelitis and radiculitis, viral central nervous system disease, prion diseases including kuru, Creutzfeldt-Jakob disease, and Gerstmann-Straussler-Scheinker syndrome, fatal familial insomnia, nutritional and metabolic diseases of the nervous system, neurofibromatosis, tuberous sclerosis, cerebelloretinal hemangioblastomatosis, encephalotrigeminal syndrome, mental retardation and other developmental disorders of the central nervous system, cerebral palsy, neuroskeletal disorders, autonomic nervous system disorders, cranial nerve disorders, spinal cord diseases, muscular dystrophy and other neuromuscular disorders, peripheral nervous system disorders, dermatomyositis and polymyositis, inherited, metabolic, endocrine, and toxic myopathies, myasthenia gravis, periodic paralysis, mental disorders including mood, anxiety, and schizophrenic disorders, seasonal affective disorder (SAD), akathisia, amnesia, catatonia, diabetic neuropathy, tardive dyskinesia, dystonias, paranoid psychoses, postherpetic neuralgia, Tourette's disorder, progressive supranuclear palsy, corticobasal degeneration, and familial frontotemporal dementia; a

cardiovascular disorder such as arteriovenous fistula, atherosclerosis, hypertension, vasculitis, Raynaud's disease, aneurysms, arterial dissections, varicose veins, thrombophlebitis and phlebothrombosis, vascular tumors, complications of thrombolysis, balloon angioplasty, vascular replacement, and coronary artery bypass graft surgery, congestive heart failure, ischemic heart disease, angina pectoris, myocardial infarction, hypertensive heart disease, degenerative valvular heart disease, calcific aortic valve stenosis, congenitally bicuspid aortic valve, mitral annular calcification, mitral valve prolapse, rheumatic fever and rheumatic heart disease, infective endocarditis, nonbacterial thrombotic endocarditis, endocarditis of systemic lupus erythematosus, carcinoid heart disease, cardiomyopathy, myocarditis, pericarditis, neoplastic heart disease, congenital heart disease, and complications of cardiac transplantation; a gastrointestinal disorder such as dysphagia, peptic esophagitis, esophageal spasm, esophageal stricture, esophageal carcinoma, dyspepsia, indigestion, gastritis, gastric carcinoma, anorexia, nausea, emesis, gastroparesis, antral or pyloric edema, abdominal angina, pyrosis, gastroenteritis, intestinal obstruction, infections of the intestinal tract, peptic ulcer, cholelithiasis, cholecystitis, cholestasis, pancreatitis, pancreatic carcinoma, biliary tract disease, hepatitis, hyperbilirubinemia, cirrhosis, passive congestion of the liver, hepatoma, infectious colitis, ulcerative colitis, ulcerative proctitis, Crohn's disease, Whipple's disease, Mallory-Weiss syndrome, colonic carcinoma, colonic obstruction, irritable bowel syndrome, short bowel syndrome, diarrhea, constipation, gastrointestinal hemorrhage, acquired immunodeficiency syndrome (AIDS) enteropathy, jaundice, hepatic encephalopathy, hepatorenal syndrome, hepatic steatosis, hemochromatosis, Wilson's disease, α_1 -antitrypsin deficiency, Reye's syndrome, primary sclerosing cholangitis, liver infarction, portal vein obstruction and thrombosis, centrilobular necrosis, peliosis hepatis, hepatic vein thrombosis, veno-occlusive disease, preeclampsia, eclampsia, acute fatty liver of pregnancy, intrahepatic cholestasis of pregnancy, and hepatic tumors including nodular hyperplasias, adenomas, and carcinomas; an autoimmune/inflammatory disorder such as acquired immunodeficiency syndrome (AIDS), Addison's disease, adult respiratory distress syndrome, allergies, ankylosing spondylitis, amyloidosis, anemia, asthma, atherosclerosis, autoimmune hemolytic anemia, autoimmune thyroiditis, autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED), bronchitis, cholecystitis, contact dermatitis, Crohn's disease, atopic dermatitis, dermatomyositis, diabetes mellitus, emphysema, episodic lymphopenia with lymphocytotoxins, erythroblastosis fetalis, erythema nodosum, atrophic gastritis, glomerulonephritis, Goodpasture's syndrome, gout, Graves' disease, Hashimoto's thyroiditis, hypereosinophilia, irritable bowel syndrome, multiple sclerosis, myasthenia gravis, myocardial or pericardial inflammation, osteoarthritis, osteoporosis, pancreatitis, polymyositis, psoriasis, Reiter's syndrome, rheumatoid arthritis, scleroderma, Sjögren's syndrome, systemic anaphylaxis, systemic lupus erythematosus, systemic sclerosis, thrombocytopenic purpura,

ulcerative colitis, uveitis, Werner syndrome, complications of cancer, hemodialysis, and extracorporeal circulation, viral, bacterial, fungal, parasitic, protozoal, and helminthic infections, and trauma; a metabolic disorder such as diabetes, obesity, and osteoporosis; and an infection by a viral agent classified as adenovirus, arenavirus, bunyavirus, calicivirus, coronavirus, filovirus, 5 hepadnavirus, herpesvirus, flavivirus, orthomyxovirus, parvovirus, papovavirus, paramyxovirus, picornavirus, poxvirus, reovirus, retrovirus, rhabdovirus, and tongavirus.

In another embodiment, a vector capable of expressing GCREC or a fragment or derivative thereof may be administered to a subject to treat or prevent a disorder associated with decreased expression or activity of GCREC including, but not limited to, those described above.

10 In a further embodiment, a composition comprising a substantially purified GCREC in conjunction with a suitable pharmaceutical carrier may be administered to a subject to treat or prevent a disorder associated with decreased expression or activity of GCREC including, but not limited to, those provided above.

In still another embodiment, an agonist which modulates the activity of GCREC may be 15 administered to a subject to treat or prevent a disorder associated with decreased expression or activity of GCREC including, but not limited to, those listed above.

In a further embodiment, an antagonist of GCREC may be administered to a subject to treat or prevent a disorder associated with increased expression or activity of GCREC. Examples of such disorders include, but are not limited to, those cell proliferative, neurological, cardiovascular, 20 gastrointestinal, autoimmune/inflammatory, and metabolic disorders, and viral infections, described above. In one aspect, an antibody which specifically binds GCREC may be used directly as an antagonist or indirectly as a targeting or delivery mechanism for bringing a pharmaceutical agent to cells or tissues which express GCREC.

In an additional embodiment, a vector expressing the complement of the polynucleotide 25 encoding GCREC may be administered to a subject to treat or prevent a disorder associated with increased expression or activity of GCREC including, but not limited to, those described above.

In other embodiments, any of the proteins, antagonists, antibodies, agonists, complementary sequences, or vectors of the invention may be administered in combination with other appropriate therapeutic agents. Selection of the appropriate agents for use in combination therapy may be made 30 by one of ordinary skill in the art, according to conventional pharmaceutical principles. The combination of therapeutic agents may act synergistically to effect the treatment or prevention of the various disorders described above. Using this approach, one may be able to achieve therapeutic efficacy with lower dosages of each agent, thus reducing the potential for adverse side effects.

An antagonist of GCREC may be produced using methods which are generally known in the 35 art. In particular, purified GCREC may be used to produce antibodies or to screen libraries of

pharmaceutical agents to identify those which specifically bind GCREC. Antibodies to GCREC may also be generated using methods that are well known in the art. Such antibodies may include, but are not limited to, polyclonal, monoclonal, chimeric, and single chain antibodies, Fab fragments, and fragments produced by a Fab expression library. Neutralizing antibodies (i.e., those which inhibit dimer formation) are generally preferred for therapeutic use.

For the production of antibodies, various hosts including goats, rabbits, rats, mice, humans, and others may be immunized by injection with GCREC or with any fragment or oligopeptide thereof which has immunogenic properties. Depending on the host species, various adjuvants may be used to increase immunological response. Such adjuvants include, but are not limited to, Freund's, mineral gels such as aluminum hydroxide, and surface active substances such as lysolecithin, pluronic polyols, polyanions, peptides, oil emulsions, KLH, and dinitrophenol. Among adjuvants used in humans, BCG (bacilli Calmette-Guerin) and Corynebacterium parvum are especially preferable.

It is preferred that the oligopeptides, peptides, or fragments used to induce antibodies to GCREC have an amino acid sequence consisting of at least about 5 amino acids, and generally will consist of at least about 10 amino acids. It is also preferable that these oligopeptides, peptides, or fragments are identical to a portion of the amino acid sequence of the natural protein. Short stretches of GCREC amino acids may be fused with those of another protein, such as KLH, and antibodies to the chimeric molecule may be produced.

Monoclonal antibodies to GCREC may be prepared using any technique which provides for the production of antibody molecules by continuous cell lines in culture. These include, but are not limited to, the hybridoma technique, the human B-cell hybridoma technique, and the EBV-hybridoma technique. (See, e.g., Kohler, G. et al. (1975) Nature 256:495-497; Kozbor, D. et al. (1985) J. Immunol. Methods 81:31-42; Cote, R.J. et al. (1983) Proc. Natl. Acad. Sci. USA 80:2026-2030; and Cole, S.P. et al. (1984) Mol. Cell Biol. 62:109-120.)

In addition, techniques developed for the production of "chimeric antibodies," such as the splicing of mouse antibody genes to human antibody genes to obtain a molecule with appropriate antigen specificity and biological activity, can be used. (See, e.g., Morrison, S.L. et al. (1984) Proc. Natl. Acad. Sci. USA 81:6851-6855; Neuberger, M.S. et al. (1984) Nature 312:604-608; and Takeda, S. et al. (1985) Nature 314:452-454.) Alternatively, techniques described for the production of single chain antibodies may be adapted, using methods known in the art, to produce GCREC-specific single chain antibodies. Antibodies with related specificity, but of distinct idiotypic composition, may be generated by chain shuffling from random combinatorial immunoglobulin libraries. (See, e.g., Burton, D.R. (1991) Proc. Natl. Acad. Sci. USA 88:10134-10137.)

Antibodies may also be produced by inducing in vivo production in the lymphocyte population or by screening immunoglobulin libraries or panels of highly specific binding reagents as

disclosed in the literature. (See, e.g., Orlandi, R. et al. (1989) Proc. Natl. Acad. Sci. USA 86:3833-3837; Winter, G. et al. (1991) Nature 349:293-299.)

Antibody fragments which contain specific binding sites for GCREC may also be generated. For example, such fragments include, but are not limited to, $F(ab')_2$ fragments produced by pepsin digestion of the antibody molecule and Fab fragments generated by reducing the disulfide bridges of the $F(ab)_2$ fragments. Alternatively, Fab expression libraries may be constructed to allow rapid and easy identification of monoclonal Fab fragments with the desired specificity. (See, e.g., Huse, W.D. et al. (1989) Science 246:1275-1281.)

Various immunoassays may be used for screening to identify antibodies having the desired specificity. Numerous protocols for competitive binding or immunoradiometric assays using either polyclonal or monoclonal antibodies with established specificities are well known in the art. Such immunoassays typically involve the measurement of complex formation between GCREC and its specific antibody. A two-site, monoclonal-based immunoassay utilizing monoclonal antibodies reactive to two non-interfering GCREC epitopes is generally used, but a competitive binding assay may also be employed (Pound, *supra*).

Various methods such as Scatchard analysis in conjunction with radioimmunoassay techniques may be used to assess the affinity of antibodies for GCREC. Affinity is expressed as an association constant, K_a , which is defined as the molar concentration of GCREC-antibody complex divided by the molar concentrations of free antigen and free antibody under equilibrium conditions. The K_a determined for a preparation of polyclonal antibodies, which are heterogeneous in their affinities for multiple GCREC epitopes, represents the average affinity, or avidity, of the antibodies for GCREC. The K_a determined for a preparation of monoclonal antibodies, which are monospecific for a particular GCREC epitope, represents a true measure of affinity. High-affinity antibody preparations with K_a ranging from about 10^9 to 10^{12} L/mole are preferred for use in immunoassays in which the GCREC-antibody complex must withstand rigorous manipulations. Low-affinity antibody preparations with K_a ranging from about 10^6 to 10^7 L/mole are preferred for use in immunopurification and similar procedures which ultimately require dissociation of GCREC, preferably in active form, from the antibody (Catty, D. (1988) Antibodies, Volume I: A Practical Approach, IRL Press, Washington DC; Liddell, J.E. and A. Cryer (1991) A Practical Guide to Monoclonal Antibodies, John Wiley & Sons, New York NY).

The titer and avidity of polyclonal antibody preparations may be further evaluated to determine the quality and suitability of such preparations for certain downstream applications. For example, a polyclonal antibody preparation containing at least 1-2 mg specific antibody/ml, preferably 5-10 mg specific antibody/ml, is generally employed in procedures requiring precipitation of GCREC-antibody complexes. Procedures for evaluating antibody specificity, titer, and avidity,

and guidelines for antibody quality and usage in various applications, are generally available. (See, e.g., Catty, supra, and Coligan et al. supra.)

In another embodiment of the invention, the polynucleotides encoding GCREC, or any fragment or complement thereof, may be used for therapeutic purposes. In one aspect, modifications of gene expression can be achieved by designing complementary sequences or antisense molecules (DNA, RNA, PNA, or modified oligonucleotides) to the coding or regulatory regions of the gene encoding GCREC. Such technology is well known in the art, and antisense oligonucleotides or larger fragments can be designed from various locations along the coding or control regions of sequences encoding GCREC. (See, e.g., Agrawal, S., ed. (1996) Antisense Therapeutics, Humana Press Inc., Totawa NJ.)

In therapeutic use, any gene delivery system suitable for introduction of the antisense sequences into appropriate target cells can be used. Antisense sequences can be delivered intracellularly in the form of an expression plasmid which, upon transcription, produces a sequence complementary to at least a portion of the cellular sequence encoding the target protein. (See, e.g., Slater, J.E. et al. (1998) *J. Allergy Clin. Immunol.* 102(3):469-475; and Scanlon, K.J. et al. (1995) 9(13):1288-1296.) Antisense sequences can also be introduced intracellularly through the use of viral vectors, such as retrovirus and adeno-associated virus vectors. (See, e.g., Miller, A.D. (1990) *Blood* 76:271; Ausubel, supra; Uckert, W. and W. Walther (1994) *Pharmacol. Ther.* 63(3):323-347.) Other gene delivery mechanisms include liposome-derived systems, artificial viral envelopes, and other systems known in the art. (See, e.g., Rossi, J.J. (1995) *Br. Med. Bull.* 51(1):217-225; Boado, R.J. et al. (1998) *J. Pharm. Sci.* 87(11):1308-1315; and Morris, M.C. et al. (1997) *Nucleic Acids Res.* 25(14):2730-2736.)

In another embodiment of the invention, polynucleotides encoding GCREC may be used for somatic or germline gene therapy. Gene therapy may be performed to (i) correct a genetic deficiency (e.g., in the cases of severe combined immunodeficiency (SCID)-X1 disease characterized by X-linked inheritance (Cavazzana-Calvo, M. et al. (2000) *Science* 288:669-672), severe combined immunodeficiency syndrome associated with an inherited adenosine deaminase (ADA) deficiency (Blaese, R.M. et al. (1995) *Science* 270:475-480; Bordignon, C. et al. (1995) *Science* 270:470-475), cystic fibrosis (Zabner, J. et al. (1993) *Cell* 75:207-216; Crystal, R.G. et al. (1995) *Hum. Gene Therapy* 6:643-666; Crystal, R.G. et al. (1995) *Hum. Gene Therapy* 6:667-703), thalassemias, familial hypercholesterolemia, and hemophilia resulting from Factor VIII or Factor IX deficiencies (Crystal, R.G. (1995) *Science* 270:404-410; Verma, I.M. and N. Somia (1997) *Nature* 389:239-242)), (ii) express a conditionally lethal gene product (e.g., in the case of cancers which result from unregulated cell proliferation), or (iii) express a protein which affords protection against intracellular parasites (e.g., against human retroviruses, such as human immunodeficiency virus (HIV) (Baltimore, D.

(1988) Nature 335:395-396; Poeschla, E. et al. (1996) Proc. Natl. Acad. Sci. USA. 93:11395-11399), hepatitis B or C virus (HBV, HCV); fungal parasites, such as Candida albicans and Paracoccidioides brasiliensis; and protozoan parasites such as Plasmodium falciparum and Trypanosoma cruzi). In the case where a genetic deficiency in GCREC expression or regulation causes disease, the expression of

5 GCREC from an appropriate population of transduced cells may alleviate the clinical manifestations caused by the genetic deficiency.

In a further embodiment of the invention, diseases or disorders caused by deficiencies in GCREC are treated by constructing mammalian expression vectors encoding GCREC and introducing these vectors by mechanical means into GCREC-deficient cells. Mechanical transfer technologies for

10 use with cells in vivo or ex vitro include (i) direct DNA microinjection into individual cells, (ii) ballistic gold particle delivery, (iii) liposome-mediated transfection, (iv) receptor-mediated gene transfer, and (v) the use of DNA transposons (Morgan, R.A. and W.F. Anderson (1993) Annu. Rev. Biochem. 62:191-217; Ivics, Z. (1997) Cell 91:501-510; Boulay, J-L. and H. Récipon (1998) Curr. Opin. Biotechnol. 9:445-450).

15 Expression vectors that may be effective for the expression of GCREC include, but are not limited to, the PCDNA 3.1, EPITAG, PRCCMV2, PREP, PVAX vectors (Invitrogen, Carlsbad CA), PCMV-SCRIPT, PCMV-TAG, PEGSH/PERV (Stratagene, La Jolla CA), and PTET-OFF, PTET-ON, PTRE2, PTRE2-LUC, PTK-HYG (Clontech, Palo Alto CA). GCREC may be expressed using (i) a constitutively active promoter, (e.g., from cytomegalovirus (CMV), Rous sarcoma virus (RSV), SV40

20 virus, thymidine kinase (TK), or β -actin genes), (ii) an inducible promoter (e.g., the tetracycline-regulated promoter (Gossen, M. and H. Bujard (1992) Proc. Natl. Acad. Sci. USA 89:5547-5551; Gossen, M. et al. (1995) Science 268:1766-1769; Rossi, F.M.V. and H.M. Blau (1998) Curr. Opin. Biotechnol. 9:451-456), commercially available in the T-REX plasmid (Invitrogen)); the ecdysone-inducible promoter (available in the plasmids PVGRXR and PIND; Invitrogen); the

25 FK506/rapamycin inducible promoter; or the RU486/mifepristone inducible promoter (Rossi, F.M.V. and Blau, H.M. supra), or (iii) a tissue-specific promoter or the native promoter of the endogenous gene encoding GCREC from a normal individual.

Commercially available liposome transformation kits (e.g., the PERFECT LIPID TRANSFECTION KIT, available from Invitrogen) allow one with ordinary skill in the art to deliver

30 polynucleotides to target cells in culture and require minimal effort to optimize experimental parameters. In the alternative, transformation is performed using the calcium phosphate method (Graham, F.L. and A.J. Eb (1973) Virology 52:456-467), or by electroporation (Neumann, E. et al. (1982) EMBO J. 1:841-845). The introduction of DNA to primary cells requires modification of these standardized mammalian transfection protocols.

35 In another embodiment of the invention, diseases or disorders caused by genetic defects with

respect to GCREC expression are treated by constructing a retrovirus vector consisting of (i) the polynucleotide encoding GCREC under the control of an independent promoter or the retrovirus long terminal repeat (LTR) promoter, (ii) appropriate RNA packaging signals, and (iii) a Rev-responsive element (RRE) along with additional retrovirus *cis*-acting RNA sequences and coding sequences required for efficient vector propagation. Retrovirus vectors (e.g., PFB and PFBNEO) are commercially available (Stratagene) and are based on published data (Riviere, I. et al. (1995) Proc. Natl. Acad. Sci. USA 92:6733-6737), incorporated by reference herein. The vector is propagated in an appropriate vector producing cell line (VPCL) that expresses an envelope gene with a tropism for receptors on the target cells or a promiscuous envelope protein such as VSVg (Armentano, D. et al. (1987) J. Virol. 61:1647-1650; Bender, M.A. et al. (1987) J. Virol. 61:1639-1646; Adam, M.A. and A.D. Miller (1988) J. Virol. 62:3802-3806; Dull, T. et al. (1998) J. Virol. 72:8463-8471; Zufferey, R. et al. (1998) J. Virol. 72:9873-9880). U.S. Patent Number 5,910,434 to Rigg ("Method for obtaining retrovirus packaging cell lines producing high transducing efficiency retroviral supernatant") discloses a method for obtaining retrovirus packaging cell lines and is hereby incorporated by reference. Propagation of retrovirus vectors, transduction of a population of cells (e.g., CD4⁺ T-cells), and the return of transduced cells to a patient are procedures well known to persons skilled in the art of gene therapy and have been well documented (Ranga, U. et al. (1997) J. Virol. 71:7020-7029; Bauer, G. et al. (1997) Blood 89:2259-2267; Bonyhadi, M.L. (1997) J. Virol. 71:4707-4716; Ranga, U. et al. (1998) Proc. Natl. Acad. Sci. USA 95:1201-1206; Su, L. (1997) Blood 89:2283-2290).

In the alternative, an adenovirus-based gene therapy delivery system is used to deliver polynucleotides encoding GCREC to cells which have one or more genetic abnormalities with respect to the expression of GCREC. The construction and packaging of adenovirus-based vectors are well known to those with ordinary skill in the art. Replication defective adenovirus vectors have proven to be versatile for importing genes encoding immunoregulatory proteins into intact islets in the pancreas (Csete, M.E. et al. (1995) Transplantation 27:263-268). Potentially useful adenoviral vectors are described in U.S. Patent Number 5,707,618 to Armentano ("Adenovirus vectors for gene therapy"), hereby incorporated by reference. For adenoviral vectors, see also Antinozzi, P.A. et al. (1999) Annu. Rev. Nutr. 19:511-544 and Verma, I.M. and N. Somia (1997) Nature 18:389:239-242, both incorporated by reference herein.

In another alternative, a herpes-based, gene therapy delivery system is used to deliver polynucleotides encoding GCREC to target cells which have one or more genetic abnormalities with respect to the expression of GCREC. The use of herpes simplex virus (HSV)-based vectors may be especially valuable for introducing GCREC to cells of the central nervous system, for which HSV has a tropism. The construction and packaging of herpes-based vectors are well known to those with

ordinary skill in the art. A replication-competent herpes simplex virus (HSV) type 1-based vector has been used to deliver a reporter gene to the eyes of primates (Liu, X. et al. (1999) *Exp. Eye Res.* 169:385-395). The construction of a HSV-1 virus vector has also been disclosed in detail in U.S. Patent Number 5,804,413 to DeLuca ("Herpes simplex virus strains for gene transfer"), which is hereby incorporated by reference. U.S. Patent Number 5,804,413 teaches the use of recombinant HSV d92 which consists of a genome containing at least one exogenous gene to be transferred to a cell under the control of the appropriate promoter for purposes including human gene therapy. Also taught by this patent are the construction and use of recombinant HSV strains deleted for ICP4, ICP27 and ICP22. For HSV vectors, see also Goins, W.F. et al. (1999) *J. Virol.* 73:519-532 and Xu, H. et al. (1994) *Dev. Biol.* 163:152-161, hereby incorporated by reference. The manipulation of cloned herpesvirus sequences, the generation of recombinant virus following the transfection of multiple plasmids containing different segments of the large herpesvirus genomes, the growth and propagation of herpesvirus, and the infection of cells with herpesvirus are techniques well known to those of ordinary skill in the art.

In another alternative, an alphavirus (positive, single-stranded RNA virus) vector is used to deliver polynucleotides encoding GCREC to target cells. The biology of the prototypic alphavirus, Semliki Forest Virus (SFV), has been studied extensively and gene transfer vectors have been based on the SFV genome (Garoff, H. and K.-J. Li (1998) *Curr. Opin. Biotechnol.* 9:464-469). During alphavirus RNA replication, a subgenomic RNA is generated that normally encodes the viral capsid proteins. This subgenomic RNA replicates to higher levels than the full length genomic RNA, resulting in the overproduction of capsid proteins relative to the viral proteins with enzymatic activity (e.g., protease and polymerase). Similarly, inserting the coding sequence for GCREC into the alphavirus genome in place of the capsid-coding region results in the production of a large number of GCREC-coding RNAs and the synthesis of high levels of GCREC in vector transduced cells. While alphavirus infection is typically associated with cell lysis within a few days, the ability to establish a persistent infection in hamster normal kidney cells (BHK-21) with a variant of Sindbis virus (SIN) indicates that the lytic replication of alphaviruses can be altered to suit the needs of the gene therapy application (Dryga, S.A. et al. (1997) *Virology* 228:74-83). The wide host range of alphaviruses will allow the introduction of GCREC into a variety of cell types. The specific transduction of a subset of cells in a population may require the sorting of cells prior to transduction. The methods of manipulating infectious cDNA clones of alphaviruses, performing alphavirus cDNA and RNA transfections, and performing alphavirus infections, are well known to those with ordinary skill in the art.

Oligonucleotides derived from the transcription initiation site, e.g., between about positions -10 and +10 from the start site, may also be employed to inhibit gene expression. Similarly,

inhibition can be achieved using triple helix base-pairing methodology. Triple helix pairing is useful because it causes inhibition of the ability of the double helix to open sufficiently for the binding of polymerases, transcription factors, or regulatory molecules. Recent therapeutic advances using triplex DNA have been described in the literature. (See, e.g., Gee, J.E. et al. (1994) in Huber, B.E. and B.I. Carr, Molecular and Immunologic Approaches, Futura Publishing, Mt. Kisco NY, pp. 163-177.) A complementary sequence or antisense molecule may also be designed to block translation of mRNA by preventing the transcript from binding to ribosomes.

Ribozymes, enzymatic RNA molecules, may also be used to catalyze the specific cleavage of RNA. The mechanism of ribozyme action involves sequence-specific hybridization of the ribozyme molecule to complementary target RNA, followed by endonucleolytic cleavage. For example, engineered hammerhead motif ribozyme molecules may specifically and efficiently catalyze endonucleolytic cleavage of sequences encoding GCRC.

Specific ribozyme cleavage sites within any potential RNA target are initially identified by scanning the target molecule for ribozyme cleavage sites, including the following sequences: GUA, GUU, and GUC. Once identified, short RNA sequences of between 15 and 20 ribonucleotides, corresponding to the region of the target gene containing the cleavage site, may be evaluated for secondary structural features which may render the oligonucleotide inoperable. The suitability of candidate targets may also be evaluated by testing accessibility to hybridization with complementary oligonucleotides using ribonuclease protection assays.

Complementary ribonucleic acid molecules and ribozymes of the invention may be prepared by any method known in the art for the synthesis of nucleic acid molecules. These include techniques for chemically synthesizing oligonucleotides such as solid phase phosphoramidite chemical synthesis. Alternatively, RNA molecules may be generated by *in vitro* and *in vivo* transcription of DNA sequences encoding GCRC. Such DNA sequences may be incorporated into a wide variety of vectors with suitable RNA polymerase promoters such as T7 or SP6. Alternatively, these cDNA constructs that synthesize complementary RNA, constitutively or inducibly, can be introduced into cell lines, cells, or tissues.

RNA molecules may be modified to increase intracellular stability and half-life. Possible modifications include, but are not limited to, the addition of flanking sequences at the 5' and/or 3' ends of the molecule, or the use of phosphorothioate or 2' O-methyl rather than phosphodiesterase linkages within the backbone of the molecule. This concept is inherent in the production of PNAs and can be extended in all of these molecules by the inclusion of nontraditional bases such as inosine, queosine, and wybutosine, as well as acetyl-, methyl-, thio-, and similarly modified forms of adenine, cytidine, guanine, thymine, and uridine which are not as easily recognized by endogenous endonucleases.

An additional embodiment of the invention encompasses a method for screening for a compound which is effective in altering expression of a polynucleotide encoding GCREC. Compounds which may be effective in altering expression of a specific polynucleotide may include, but are not limited to, oligonucleotides, antisense oligonucleotides, triple helix-forming
5 oligonucleotides, transcription factors and other polypeptide transcriptional regulators, and non-macromolecular chemical entities which are capable of interacting with specific polynucleotide sequences. Effective compounds may alter polynucleotide expression by acting as either inhibitors or promoters of polynucleotide expression. Thus, in the treatment of disorders associated with increased GCREC expression or activity, a compound which specifically inhibits expression of the
10 polynucleotide encoding GCREC may be therapeutically useful, and in the treatment of disorders associated with decreased GCREC expression or activity, a compound which specifically promotes expression of the polynucleotide encoding GCREC may be therapeutically useful.

At least one, and up to a plurality, of test compounds may be screened for effectiveness in altering expression of a specific polynucleotide. A test compound may be obtained by any method
15 commonly known in the art, including chemical modification of a compound known to be effective in altering polynucleotide expression; selection from an existing, commercially-available or proprietary library of naturally-occurring or non-natural chemical compounds; rational design of a compound based on chemical and/or structural properties of the target polynucleotide; and selection from a library of chemical compounds created combinatorially or randomly. A sample comprising a
20 polynucleotide encoding GCREC is exposed to at least one test compound thus obtained. The sample may comprise, for example, an intact or permeabilized cell, or an *in vitro* cell-free or reconstituted biochemical system. Alterations in the expression of a polynucleotide encoding GCREC are assayed by any method commonly known in the art. Typically, the expression of a specific nucleotide is detected by hybridization with a probe having a nucleotide sequence complementary to the sequence
25 of the polynucleotide encoding GCREC. The amount of hybridization may be quantified, thus forming the basis for a comparison of the expression of the polynucleotide both with and without exposure to one or more test compounds. Detection of a change in the expression of a polynucleotide exposed to a test compound indicates that the test compound is effective in altering the expression of the polynucleotide. A screen for a compound effective in altering expression of a specific
30 polynucleotide can be carried out, for example, using a *Schizosaccharomyces pombe* gene expression system (Atkins, D. et al. (1999) U.S. Patent No. 5,932,435; Arndt, G.M. et al. (2000) Nucleic Acids Res. 28:E15) or a human cell line such as HeLa cell (Clarke, M.L. et al. (2000) Biochem. Biophys. Res. Commun. 268:8-13). A particular embodiment of the present invention involves screening a combinatorial library of oligonucleotides (such as deoxyribonucleotides, ribonucleotides, peptide
35 nucleic acids, and modified oligonucleotides) for antisense activity against a specific polynucleotide

sequence (Bruice, T.W. et al. (1997) U.S. Patent No. 5,686,242; Bruice, T.W. et al. (2000) U.S. Patent No. 6,022,691).

Many methods for introducing vectors into cells or tissues are available and equally suitable for use in vivo, in vitro, and ex vivo. For ex vivo therapy, vectors may be introduced into stem cells taken from the patient and clonally propagated for autologous transplant back into that same patient. Delivery by transfection, by liposome injections, or by polycationic amino polymers may be achieved using methods which are well known in the art. (See, e.g., Goldman, C.K. et al. (1997) Nat. Biotechnol. 15:462-466.)

Any of the therapeutic methods described above may be applied to any subject in need of such therapy, including, for example, mammals such as humans, dogs, cats, cows, horses, rabbits, and monkeys.

An additional embodiment of the invention relates to the administration of a composition which generally comprises an active ingredient formulated with a pharmaceutically acceptable excipient. Excipients may include, for example, sugars, starches, celluloses, gums, and proteins. Various formulations are commonly known and are thoroughly discussed in the latest edition of Remington's Pharmaceutical Sciences (Maack Publishing, Easton PA). Such compositions may consist of GCREC, antibodies to GCREC, and mimetics, agonists, antagonists, or inhibitors of GCREC.

The compositions utilized in this invention may be administered by any number of routes including, but not limited to, oral, intravenous, intramuscular, intra-arterial, intramedullary, intrathecal, intraventricular, pulmonary, transdermal, subcutaneous, intraperitoneal, intranasal, enteral, topical, sublingual, or rectal means.

Compositions for pulmonary administration may be prepared in liquid or dry powder form. These compositions are generally aerosolized immediately prior to inhalation by the patient. In the case of small molecules (e.g. traditional low molecular weight organic drugs), aerosol delivery of fast-acting formulations is well-known in the art. In the case of macromolecules (e.g. larger peptides and proteins), recent developments in the field of pulmonary delivery via the alveolar region of the lung have enabled the practical delivery of drugs such as insulin to blood circulation (see, e.g., Patton, J.S. et al., U.S. Patent No. 5,997,848). Pulmonary delivery has the advantage of administration without needle injection, and obviates the need for potentially toxic penetration enhancers.

Compositions suitable for use in the invention include compositions wherein the active ingredients are contained in an effective amount to achieve the intended purpose. The determination of an effective dose is well within the capability of those skilled in the art.

Specialized forms of compositions may be prepared for direct intracellular delivery of macromolecules comprising GCREC or fragments thereof. For example, liposome preparations

containing a cell-impermeable macromolecule may promote cell fusion and intracellular delivery of the macromolecule. Alternatively, GCREC or a fragment thereof may be joined to a short cationic N-terminal portion from the HIV Tat-1 protein. Fusion proteins thus generated have been found to transduce into the cells of all tissues, including the brain, in a mouse model system (Schwarze, S.R. et al. (1999) Science 285:1569-1572).

For any compound, the therapeutically effective dose can be estimated initially either in cell culture assays, e.g., of neoplastic cells, or in animal models such as mice, rats, rabbits, dogs, monkeys, or pigs. An animal model may also be used to determine the appropriate concentration range and route of administration. Such information can then be used to determine useful doses and routes for administration in humans.

A therapeutically effective dose refers to that amount of active ingredient, for example GCREC or fragments thereof, antibodies of GCREC, and agonists, antagonists or inhibitors of GCREC, which ameliorates the symptoms or condition. Therapeutic efficacy and toxicity may be determined by standard pharmaceutical procedures in cell cultures or with experimental animals, such as by calculating the ED_{50} (the dose therapeutically effective in 50% of the population) or LD_{50} (the dose lethal to 50% of the population) statistics. The dose ratio of toxic to therapeutic effects is the therapeutic index, which can be expressed as the LD_{50}/ED_{50} ratio. Compositions which exhibit large therapeutic indices are preferred. The data obtained from cell culture assays and animal studies are used to formulate a range of dosage for human use. The dosage contained in such compositions is preferably within a range of circulating concentrations that includes the ED_{50} with little or no toxicity. The dosage varies within this range depending upon the dosage form employed, the sensitivity of the patient, and the route of administration.

The exact dosage will be determined by the practitioner, in light of factors related to the subject requiring treatment. Dosage and administration are adjusted to provide sufficient levels of the active moiety or to maintain the desired effect. Factors which may be taken into account include the severity of the disease state, the general health of the subject, the age, weight, and gender of the subject, time and frequency of administration, drug combination(s), reaction sensitivities, and response to therapy. Long-acting compositions may be administered every 3 to 4 days, every week, or biweekly depending on the half-life and clearance rate of the particular formulation.

Normal dosage amounts may vary from about 0.1 μg to 100,000 μg , up to a total dose of about 1 gram, depending upon the route of administration. Guidance as to particular dosages and methods of delivery is provided in the literature and generally available to practitioners in the art. Those skilled in the art will employ different formulations for nucleotides than for proteins or their inhibitors. Similarly, delivery of polynucleotides or polypeptides will be specific to particular cells, conditions, locations, etc.

DIAGNOSTICS

In another embodiment, antibodies which specifically bind GCREC may be used for the diagnosis of disorders characterized by expression of GCREC, or in assays to monitor patients being treated with GCREC or agonists, antagonists, or inhibitors of GCREC. Antibodies useful for diagnostic purposes may be prepared in the same manner as described above for therapeutics. Diagnostic assays for GCREC include methods which utilize the antibody and a label to detect GCREC in human body fluids or in extracts of cells or tissues. The antibodies may be used with or without modification, and may be labeled by covalent or non-covalent attachment of a reporter molecule. A wide variety of reporter molecules, several of which are described above, are known in the art and may be used.

A variety of protocols for measuring GCREC, including ELISAs, RIAs, and FACS, are known in the art and provide a basis for diagnosing altered or abnormal levels of GCREC expression. Normal or standard values for GCREC expression are established by combining body fluids or cell extracts taken from normal mammalian subjects, for example, human subjects, with antibodies to GCREC under conditions suitable for complex formation. The amount of standard complex formation may be quantitated by various methods, such as photometric means. Quantities of GCREC expressed in subject, control, and disease samples from biopsied tissues are compared with the standard values. Deviation between standard and subject values establishes the parameters for diagnosing disease.

In another embodiment of the invention, the polynucleotides encoding GCREC may be used for diagnostic purposes. The polynucleotides which may be used include oligonucleotide sequences, complementary RNA and DNA molecules, and PNAs. The polynucleotides may be used to detect and quantify gene expression in biopsied tissues in which expression of GCREC may be correlated with disease. The diagnostic assay may be used to determine absence, presence, and excess expression of GCREC, and to monitor regulation of GCREC levels during therapeutic intervention.

In one aspect, hybridization with PCR probes which are capable of detecting polynucleotide sequences, including genomic sequences, encoding GCREC or closely related molecules may be used to identify nucleic acid sequences which encode GCREC. The specificity of the probe, whether it is made from a highly specific region, e.g., the 5' regulatory region, or from a less specific region, e.g., a conserved motif, and the stringency of the hybridization or amplification will determine whether the probe identifies only naturally occurring sequences encoding GCREC, allelic variants, or related sequences.

Probes may also be used for the detection of related sequences, and may have at least 50% sequence identity to any of the GCREC encoding sequences. The hybridization probes of the subject invention may be DNA or RNA and may be derived from the sequence of SEQ ID NO:24-46 or from

genomic sequences including promoters, enhancers, and introns of the GCREC gene.

Means for producing specific hybridization probes for DNAs encoding GCREC include the cloning of polynucleotide sequences encoding GCREC or GCREC derivatives into vectors for the production of mRNA probes. Such vectors are known in the art, are commercially available, and may
5 be used to synthesize RNA probes in vitro by means of the addition of the appropriate RNA polymerases and the appropriate labeled nucleotides. Hybridization probes may be labeled by a variety of reporter groups, for example, by radionuclides such as ^{32}P or ^{35}S , or by enzymatic labels, such as alkaline phosphatase coupled to the probe via avidin/biotin coupling systems, and the like.

Polynucleotide sequences encoding GCREC may be used for the diagnosis of disorders
10 associated with expression of GCREC. Examples of such disorders include, but are not limited to, a cell proliferative disorder such as actinic keratosis, arteriosclerosis, atherosclerosis, bursitis, cirrhosis, hepatitis, mixed connective tissue disease (MCTD), myelofibrosis, paroxysmal nocturnal hemoglobinuria, polycythemia vera, psoriasis, primary thrombocythemia, and cancers including adenocarcinoma, leukemia, lymphoma, melanoma, myeloma, sarcoma, teratocarcinoma, and, in
15 particular, cancers of the adrenal gland, bladder, bone, bone marrow, brain, breast, cervix, gall bladder, ganglia, gastrointestinal tract, heart, kidney, liver, lung, muscle, ovary, pancreas, parathyroid, penis, prostate, salivary glands, skin, spleen, testis, thymus, thyroid, and uterus; a neurological disorder such as epilepsy, ischemic cerebrovascular disease, stroke, cerebral neoplasms, Alzheimer's disease, Pick's disease, Huntington's disease, dementia, Parkinson's disease and other
20 extrapyramidal disorders, amyotrophic lateral sclerosis and other motor neuron disorders, progressive neural muscular atrophy, retinitis pigmentosa, hereditary ataxias, multiple sclerosis and other demyelinating diseases, bacterial and viral meningitis, brain abscess, subdural empyema, epidural abscess, suppurative intracranial thrombophlebitis, myelitis and radiculitis, viral central nervous system disease, prion diseases including kuru, Creutzfeldt-Jakob disease, and Gerstmann-
25 Straussler-Scheinker syndrome, fatal familial insomnia, nutritional and metabolic diseases of the nervous system, neurofibromatosis, tuberous sclerosis, cerebelloretinal hemangioblastomatosis, encephalotrigeminal syndrome, mental retardation and other developmental disorders of the central nervous system, cerebral palsy, neuroskeletal disorders, autonomic nervous system disorders, cranial nerve disorders, spinal cord diseases, muscular dystrophy and other neuromuscular disorders,
30 peripheral nervous system disorders, dermatomyositis and polymyositis, inherited, metabolic, endocrine, and toxic myopathies, myasthenia gravis, periodic paralysis, mental disorders including mood, anxiety, and schizophrenic disorders, seasonal affective disorder (SAD), akathisia, amnesia, catatonia, diabetic neuropathy, tardive dyskinesia, dystonias, paranoid psychoses, postherpetic neuralgia, Tourette's disorder, progressive supranuclear palsy, corticobasal degeneration, and familial
35 frontotemporal dementia; a cardiovascular disorder such as arteriovenous fistula, atherosclerosis,

hypertension, vasculitis, Raynaud's disease, aneurysms, arterial dissections, varicose veins, thrombophlebitis and phlebothrombosis, vascular tumors, complications of thrombolysis, balloon angioplasty, vascular replacement, and coronary artery bypass graft surgery, congestive heart failure, ischemic heart disease, angina pectoris, myocardial infarction, hypertensive heart disease,

5 degenerative valvular heart disease, calcific aortic valve stenosis, congenitally bicuspid aortic valve, mitral annular calcification, mitral valve prolapse, rheumatic fever and rheumatic heart disease, infective endocarditis, nonbacterial thrombotic endocarditis, endocarditis of systemic lupus erythematosus, carcinoid heart disease, cardiomyopathy, myocarditis, pericarditis, neoplastic heart disease, congenital heart disease, and complications of cardiac transplantation; a gastrointestinal

10 disorder such as dysphagia, peptic esophagitis, esophageal spasm, esophageal stricture, esophageal carcinoma, dyspepsia, indigestion, gastritis, gastric carcinoma, anorexia, nausea, emesis, gastroparesis, antral or pyloric edema, abdominal angina, pyrosis, gastroenteritis, intestinal obstruction, infections of the intestinal tract, peptic ulcer, cholelithiasis, cholecystitis, cholestasis, pancreatitis, pancreatic carcinoma, biliary tract disease, hepatitis, hyperbilirubinemia, cirrhosis,

15 passive congestion of the liver, hepatoma, infectious colitis, ulcerative colitis, ulcerative proctitis, Crohn's disease, Whipple's disease, Mallory-Weiss syndrome, colonic carcinoma, colonic obstruction, irritable bowel syndrome, short bowel syndrome, diarrhea, constipation, gastrointestinal hemorrhage, acquired immunodeficiency syndrome (AIDS) enteropathy, jaundice, hepatic encephalopathy, hepatorenal syndrome, hepatic steatosis, hemochromatosis, Wilson's disease, alpha₁-

20 antitrypsin deficiency, Reye's syndrome, primary sclerosing cholangitis, liver infarction, portal vein obstruction and thrombosis, centrilobular necrosis, peliosis hepatis, hepatic vein thrombosis, veno-occlusive disease, preeclampsia, eclampsia, acute fatty liver of pregnancy, intrahepatic cholestasis of pregnancy, and hepatic tumors including nodular hyperplasias, adenomas, and carcinomas; an autoimmune/inflammatory disorder such as acquired immunodeficiency syndrome (AIDS),

25 Addison's disease, adult respiratory distress syndrome, allergies, ankylosing spondylitis, amyloidosis, anemia, asthma, atherosclerosis, autoimmune hemolytic anemia, autoimmune thyroiditis, autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED), bronchitis, cholecystitis, contact dermatitis, Crohn's disease, atopic dermatitis, dermatomyositis, diabetes mellitus, emphysema, episodic lymphopenia with lymphocytotoxins, erythroblastosis fetalis,

30 erythema nodosum, atrophic gastritis, glomerulonephritis, Goodpasture's syndrome, gout, Graves' disease, Hashimoto's thyroiditis, hypereosinophilia, irritable bowel syndrome, multiple sclerosis, myasthenia gravis, myocardial or pericardial inflammation, osteoarthritis, osteoporosis, pancreatitis, polymyositis, psoriasis, Reiter's syndrome, rheumatoid arthritis, scleroderma, Sjögren's syndrome, systemic anaphylaxis, systemic lupus erythematosus, systemic sclerosis, thrombocytopenic purpura,

35 ulcerative colitis, uveitis, Werner syndrome, complications of cancer, hemodialysis, and

extracorporeal circulation, viral, bacterial, fungal, parasitic, protozoal, and helminthic infections, and trauma; a metabolic disorder such as diabetes, obesity, and osteoporosis; and an infection by a viral agent classified as adenovirus, arenavirus, bunyavirus, calicivirus, coronavirus, filovirus, hepadnavirus, herpesvirus, flavivirus, orthomyxovirus, parvovirus, papovavirus, paramyxovirus, 5 picornavirus, poxvirus, reovirus, retrovirus, rhabdovirus, and tongavirus. The polynucleotide sequences encoding GCREC may be used in Southern or northern analysis, dot blot, or other membrane-based technologies; in PCR technologies; in dipstick, pin, and multiformat ELISA-like assays; and in microarrays utilizing fluids or tissues from patients to detect altered GCREC expression. Such qualitative or quantitative methods are well known in the art.

10 In a particular aspect, the nucleotide sequences encoding GCREC may be useful in assays that detect the presence of associated disorders, particularly those mentioned above. The nucleotide sequences encoding GCREC may be labeled by standard methods and added to a fluid or tissue sample from a patient under conditions suitable for the formation of hybridization complexes. After a suitable incubation period, the sample is washed and the signal is quantified and compared with a 15 standard value. If the amount of signal in the patient sample is significantly altered in comparison to a control sample then the presence of altered levels of nucleotide sequences encoding GCREC in the sample indicates the presence of the associated disorder. Such assays may also be used to evaluate the efficacy of a particular therapeutic treatment regimen in animal studies, in clinical trials, or to monitor the treatment of an individual patient.

20 In order to provide a basis for the diagnosis of a disorder associated with expression of GCREC, a normal or standard profile for expression is established. This may be accomplished by combining body fluids or cell extracts taken from normal subjects, either animal or human, with a sequence, or a fragment thereof, encoding GCREC, under conditions suitable for hybridization or amplification. Standard hybridization may be quantified by comparing the values obtained from 25 normal subjects with values from an experiment in which a known amount of a substantially purified polynucleotide is used. Standard values obtained in this manner may be compared with values obtained from samples from patients who are symptomatic for a disorder. Deviation from standard values is used to establish the presence of a disorder.

Once the presence of a disorder is established and a treatment protocol is initiated, 30 hybridization assays may be repeated on a regular basis to determine if the level of expression in the patient begins to approximate that which is observed in the normal subject. The results obtained from successive assays may be used to show the efficacy of treatment over a period ranging from several days to months.

With respect to cancer, the presence of an abnormal amount of transcript (either under- or 35 overexpressed) in biopsied tissue from an individual may indicate a predisposition for the

development of the disease, or may provide a means for detecting the disease prior to the appearance of actual clinical symptoms. A more definitive diagnosis of this type may allow health professionals to employ preventative measures or aggressive treatment earlier thereby preventing the development or further progression of the cancer.

5 Additional diagnostic uses for oligonucleotides designed from the sequences encoding GCREC may involve the use of PCR. These oligomers may be chemically synthesized, generated enzymatically, or produced in vitro. Oligomers will preferably contain a fragment of a polynucleotide encoding GCREC, or a fragment of a polynucleotide complementary to the polynucleotide encoding GCREC, and will be employed under optimized conditions for identification of a specific gene or
10 condition. Oligomers may also be employed under less stringent conditions for detection or quantification of closely related DNA or RNA sequences.

In a particular aspect, oligonucleotide primers derived from the polynucleotide sequences encoding GCREC may be used to detect single nucleotide polymorphisms (SNPs). SNPs are substitutions, insertions and deletions that are a frequent cause of inherited or acquired genetic
15 disease in humans. Methods of SNP detection include, but are not limited to, single-stranded conformation polymorphism (SSCP) and fluorescent SSCP (fSSCP) methods. In SSCP, oligonucleotide primers derived from the polynucleotide sequences encoding GCREC are used to amplify DNA using the polymerase chain reaction (PCR). The DNA may be derived, for example, from diseased or normal tissue, biopsy samples, bodily fluids, and the like. SNPs in the DNA cause
20 differences in the secondary and tertiary structures of PCR products in single-stranded form, and these differences are detectable using gel electrophoresis in non-denaturing gels. In fSSCP, the oligonucleotide primers are fluorescently labeled, which allows detection of the amplimers in high-throughput equipment such as DNA sequencing machines. Additionally, sequence database analysis methods, termed *in silico* SNP (isSNP), are capable of identifying polymorphisms by comparing the
25 sequence of individual overlapping DNA fragments which assemble into a common consensus sequence. These computer-based methods filter out sequence variations due to laboratory preparation of DNA and sequencing errors using statistical models and automated analyses of DNA sequence chromatograms. In the alternative, SNPs may be detected and characterized by mass spectrometry using, for example, the high throughput MASSARRAY system (Sequenom, Inc., San Diego CA).

30 Methods which may also be used to quantify the expression of GCREC include radiolabeling or biotinylating nucleotides, coamplification of a control nucleic acid, and interpolating results from standard curves. (See, e.g., Melby, P.C. et al. (1993) J. Immunol. Methods 159:235-244; Duplaa, C. et al. (1993) Anal. Biochem. 212:229-236.) The speed of quantitation of multiple samples may be accelerated by running the assay in a high-throughput format where the oligomer or polynucleotide of
35 interest is presented in various dilutions and a spectrophotometric or colorimetric response gives

rapid quantitation.

In further embodiments, oligonucleotides or longer fragments derived from any of the polynucleotide sequences described herein may be used as elements on a microarray. The microarray can be used in transcript imaging techniques which monitor the relative expression levels of large numbers of genes simultaneously as described below. The microarray may also be used to identify genetic variants, mutations, and polymorphisms. This information may be used to determine gene function, to understand the genetic basis of a disorder, to diagnose a disorder, to monitor progression/regression of disease as a function of gene expression, and to develop and monitor the activities of therapeutic agents in the treatment of disease. In particular, this information may be used to develop a pharmacogenomic profile of a patient in order to select the most appropriate and effective treatment regimen for that patient. For example, therapeutic agents which are highly effective and display the fewest side effects may be selected for a patient based on his/her pharmacogenomic profile.

In another embodiment, GCREC, fragments of GCREC, or antibodies specific for GCREC may be used as elements on a microarray. The microarray may be used to monitor or measure protein-protein interactions, drug-target interactions, and gene expression profiles, as described above.

A particular embodiment relates to the use of the polynucleotides of the present invention to generate a transcript image of a tissue or cell type. A transcript image represents the global pattern of gene expression by a particular tissue or cell type. Global gene expression patterns are analyzed by quantifying the number of expressed genes and their relative abundance under given conditions and at a given time. (See Seilhamer et al., "Comparative Gene Transcript Analysis," U.S. Patent Number 5,840,484, expressly incorporated by reference herein.) Thus a transcript image may be generated by hybridizing the polynucleotides of the present invention or their complements to the totality of transcripts or reverse transcripts of a particular tissue or cell type. In one embodiment, the hybridization takes place in high-throughput format, wherein the polynucleotides of the present invention or their complements comprise a subset of a plurality of elements on a microarray. The resultant transcript image would provide a profile of gene activity.

Transcript images may be generated using transcripts isolated from tissues, cell lines, biopsies, or other biological samples. The transcript image may thus reflect gene expression in vivo, as in the case of a tissue or biopsy sample, or in vitro, as in the case of a cell line.

Transcript images which profile the expression of the polynucleotides of the present invention may also be used in conjunction with in vitro model systems and preclinical evaluation of pharmaceuticals, as well as toxicological testing of industrial and naturally-occurring environmental compounds. All compounds induce characteristic gene expression patterns, frequently termed

molecular fingerprints or toxicant signatures, which are indicative of mechanisms of action and toxicity (Nuwaysir, E.F. et al. (1999) *Mol. Carcinog.* 24:153-159; Steiner, S. and N.L. Anderson (2000) *Toxicol. Lett.* 112-113:467-471, expressly incorporated by reference herein). If a test compound has a signature similar to that of a compound with known toxicity, it is likely to share those toxic properties. These fingerprints or signatures are most useful and refined when they contain expression information from a large number of genes and gene families. Ideally, a genome-wide measurement of expression provides the highest quality signature. Even genes whose expression is not altered by any tested compounds are important as well, as the levels of expression of these genes are used to normalize the rest of the expression data. The normalization procedure is useful for comparison of expression data after treatment with different compounds. While the assignment of gene function to elements of a toxicant signature aids in interpretation of toxicity mechanisms, knowledge of gene function is not necessary for the statistical matching of signatures which leads to prediction of toxicity. (See, for example, Press Release 00-02 from the National Institute of Environmental Health Sciences, released February 29, 2000, available at <http://www.niehs.nih.gov/oc/news/toxchip.htm>.) Therefore, it is important and desirable in toxicological screening using toxicant signatures to include all expressed gene sequences.

In one embodiment, the toxicity of a test compound is assessed by treating a biological sample containing nucleic acids with the test compound. Nucleic acids that are expressed in the treated biological sample are hybridized with one or more probes specific to the polynucleotides of the present invention, so that transcript levels corresponding to the polynucleotides of the present invention may be quantified. The transcript levels in the treated biological sample are compared with levels in an untreated biological sample. Differences in the transcript levels between the two samples are indicative of a toxic response caused by the test compound in the treated sample.

Another particular embodiment relates to the use of the polypeptide sequences of the present invention to analyze the proteome of a tissue or cell type. The term proteome refers to the global pattern of protein expression in a particular tissue or cell type. Each protein component of a proteome can be subjected individually to further analysis. Proteome expression patterns, or profiles, are analyzed by quantifying the number of expressed proteins and their relative abundance under given conditions and at a given time. A profile of a cell's proteome may thus be generated by separating and analyzing the polypeptides of a particular tissue or cell type. In one embodiment, the separation is achieved using two-dimensional gel electrophoresis, in which proteins from a sample are separated by isoelectric focusing in the first dimension, and then according to molecular weight by sodium dodecyl sulfate slab gel electrophoresis in the second dimension (Steiner and Anderson, *supra*). The proteins are visualized in the gel as discrete and uniquely positioned spots, typically by staining the gel with an agent such as Coomassie Blue or silver or fluorescent stains. The optical

density of each protein spot is generally proportional to the level of the protein in the sample. The optical densities of equivalently positioned protein spots from different samples, for example, from biological samples either treated or untreated with a test compound or therapeutic agent, are compared to identify any changes in protein spot density related to the treatment. The proteins in the spots are partially sequenced using, for example, standard methods employing chemical or enzymatic cleavage followed by mass spectrometry. The identity of the protein in a spot may be determined by comparing its partial sequence, preferably of at least 5 contiguous amino acid residues, to the polypeptide sequences of the present invention. In some cases, further sequence data may be obtained for definitive protein identification.

A proteomic profile may also be generated using antibodies specific for GCREC to quantify the levels of GCREC expression. In one embodiment, the antibodies are used as elements on a microarray, and protein expression levels are quantified by exposing the microarray to the sample and detecting the levels of protein bound to each array element (Lueking, A. et al. (1999) *Anal. Biochem.* 270:103-111; Mendoze, L.G. et al. (1999) *Biotechniques* 27:778-788). Detection may be performed by a variety of methods known in the art, for example, by reacting the proteins in the sample with a thiol- or amino-reactive fluorescent compound and detecting the amount of fluorescence bound at each array element.

Toxicant signatures at the proteome level are also useful for toxicological screening, and should be analyzed in parallel with toxicant signatures at the transcript level. There is a poor correlation between transcript and protein abundances for some proteins in some tissues (Anderson, N.L. and J. Seilhamer (1997) *Electrophoresis* 18:533-537), so proteome toxicant signatures may be useful in the analysis of compounds which do not significantly affect the transcript image, but which alter the proteomic profile. In addition, the analysis of transcripts in body fluids is difficult, due to rapid degradation of mRNA, so proteomic profiling may be more reliable and informative in such cases.

In another embodiment, the toxicity of a test compound is assessed by treating a biological sample containing proteins with the test compound. Proteins that are expressed in the treated biological sample are separated so that the amount of each protein can be quantified. The amount of each protein is compared to the amount of the corresponding protein in an untreated biological sample. A difference in the amount of protein between the two samples is indicative of a toxic response to the test compound in the treated sample. Individual proteins are identified by sequencing the amino acid residues of the individual proteins and comparing these partial sequences to the polypeptides of the present invention.

In another embodiment, the toxicity of a test compound is assessed by treating a biological sample containing proteins with the test compound. Proteins from the biological sample are

incubated with antibodies specific to the polypeptides of the present invention. The amount of protein recognized by the antibodies is quantified. The amount of protein in the treated biological sample is compared with the amount in an untreated biological sample. A difference in the amount of protein between the two samples is indicative of a toxic response to the test compound in the treated sample.

Microarrays may be prepared, used, and analyzed using methods known in the art. (See, e.g., Brennan, T.M. et al. (1995) U.S. Patent No. 5,474,796; Schena, M. et al. (1996) Proc. Natl. Acad. Sci. USA 93:10614-10619; Baldeschweiler et al. (1995) PCT application WO95/251116; Shalon, D. et al. (1995) PCT application WO95/35505; Heller, R.A. et al. (1997) Proc. Natl. Acad. Sci. USA 94:2150-2155; and Heller, M.J. et al. (1997) U.S. Patent No. 5,605,662.) Various types of microarrays are well known and thoroughly described in DNA Microarrays: A Practical Approach, M. Schena, ed. (1999) Oxford University Press, London, hereby expressly incorporated by reference.

In another embodiment of the invention, nucleic acid sequences encoding GCREC may be used to generate hybridization probes useful in mapping the naturally occurring genomic sequence. Either coding or noncoding sequences may be used, and in some instances, noncoding sequences may be preferable over coding sequences. For example, conservation of a coding sequence among members of a multi-gene family may potentially cause undesired cross hybridization during chromosomal mapping. The sequences may be mapped to a particular chromosome, to a specific region of a chromosome, or to artificial chromosome constructions, e.g., human artificial chromosomes (HACs), yeast artificial chromosomes (YACs), bacterial artificial chromosomes (BACs), bacterial P1 constructions, or single chromosome cDNA libraries. (See, e.g., Harrington, J.J. et al. (1997) Nat. Genet. 15:345-355; Price, C.M. (1993) Blood Rev. 7:127-134; and Trask, B.J. (1991) Trends Genet. 7:149-154.) Once mapped, the nucleic acid sequences of the invention may be used to develop genetic linkage maps, for example, which correlate the inheritance of a disease state with the inheritance of a particular chromosome region or restriction fragment length polymorphism (RFLP). (See, for example, Lander, E.S. and D. Botstein (1986) Proc. Natl. Acad. Sci. USA 83:7353-7357.)

Fluorescent in situ hybridization (FISH) may be correlated with other physical and genetic map data. (See, e.g., Heinz-Ulrich, et al. (1995) in Meyers, supra, pp. 965-968.) Examples of genetic map data can be found in various scientific journals or at the Online Mendelian Inheritance in Man (OMIM) World Wide Web site. Correlation between the location of the gene encoding GCREC on a physical map and a specific disorder, or a predisposition to a specific disorder, may help define the region of DNA associated with that disorder and thus may further positional cloning efforts.

In situ hybridization of chromosomal preparations and physical mapping techniques, such as linkage analysis using established chromosomal markers, may be used for extending genetic maps.

Often the placement of a gene on the chromosome of another mammalian species, such as mouse, may reveal associated markers even if the exact chromosomal locus is not known. This information is valuable to investigators searching for disease genes using positional cloning or other gene discovery techniques. Once the gene or genes responsible for a disease or syndrome have been crudely
5 localized by genetic linkage to a particular genomic region, e.g., ataxia-telangiectasia to 11q22-23, any sequences mapping to that area may represent associated or regulatory genes for further investigation. (See, e.g., Gatti, R.A. et al. (1988) *Nature* 336:577-580.) The nucleotide sequence of the instant invention may also be used to detect differences in the chromosomal location due to translocation, inversion, etc., among normal, carrier, or affected individuals.

10 In another embodiment of the invention, GCREC, its catalytic or immunogenic fragments, or oligopeptides thereof can be used for screening libraries of compounds in any of a variety of drug screening techniques. The fragment employed in such screening may be free in solution, affixed to a solid support, borne on a cell surface, or located intracellularly. The formation of binding complexes between GCREC and the agent being tested may be measured.

15 Another technique for drug screening provides for high throughput screening of compounds having suitable binding affinity to the protein of interest. (See, e.g., Geysen, et al. (1984) PCT application WO84/03564.) In this method, large numbers of different small test compounds are synthesized on a solid substrate. The test compounds are reacted with GCREC, or fragments thereof, and washed. Bound GCREC is then detected by methods well known in the art. Purified GCREC
20 can also be coated directly onto plates for use in the aforementioned drug screening techniques. Alternatively, non-neutralizing antibodies can be used to capture the peptide and immobilize it on a solid support.

In another embodiment, one may use competitive drug screening assays in which neutralizing antibodies capable of binding GCREC specifically compete with a test compound for binding
25 GCREC. In this manner, antibodies can be used to detect the presence of any peptide which shares one or more antigenic determinants with GCREC.

In additional embodiments, the nucleotide sequences which encode GCREC may be used in any molecular biology techniques that have yet to be developed, provided the new techniques rely on properties of nucleotide sequences that are currently known, including, but not limited to, such
30 properties as the triplet genetic code and specific base pair interactions.

Without further elaboration, it is believed that one skilled in the art can, using the preceding description, utilize the present invention to its fullest extent. The following embodiments are, therefore, to be construed as merely illustrative, and not limitative of the remainder of the disclosure in any way whatsoever.

35 The disclosures of all patents, applications and publications, mentioned above and below,

including U.S. Ser. No. 60/208,834, U.S. Ser. No. 60/206,222, U.S. Ser. No. 60/207,476, U.S. Ser. No. 60/208,861, and U.S. Ser. No. 60/209,868, are expressly incorporated by reference herein.

EXAMPLES

5 I. Construction of cDNA Libraries

Incyte cDNAs were derived from cDNA libraries described in the LIFESEQ GOLD database (Incyte Genomics, Palo Alto CA) and shown in Table 4, column 5. Some tissues were homogenized and lysed in guanidinium isothiocyanate, while others were homogenized and lysed in phenol or in a suitable mixture of denaturants, such as TRIZOL (Life Technologies), a monophasic solution of
10 phenol and guanidine isothiocyanate. The resulting lysates were centrifuged over CsCl cushions or extracted with chloroform. RNA was precipitated from the lysates with either isopropanol or sodium acetate and ethanol, or by other routine methods.

Phenol extraction and precipitation of RNA were repeated as necessary to increase RNA purity. In some cases, RNA was treated with DNase. For most libraries, poly(A)+ RNA was isolated
15 using oligo d(T)-coupled paramagnetic particles (Promega), OLIGOTEX latex particles (QIAGEN, Chatsworth CA), or an OLIGOTEX mRNA purification kit (QIAGEN). Alternatively, RNA was isolated directly from tissue lysates using other RNA isolation kits, e.g., the POLY(A)PURE mRNA purification kit (Ambion, Austin TX).

In some cases, Stratagene was provided with RNA and constructed the corresponding cDNA
20 libraries. Otherwise, cDNA was synthesized and cDNA libraries were constructed with the UNIZAP vector system (Stratagene) or SUPERScript plasmid system (Life Technologies), using the recommended procedures or similar methods known in the art. (See, e.g., Ausubel, 1997, supra, units 5.1-6.6.) Reverse transcription was initiated using oligo d(T) or random primers. Synthetic oligonucleotide adapters were ligated to double stranded cDNA, and the cDNA was digested with the
25 appropriate restriction enzyme or enzymes. For most libraries, the cDNA was size-selected (300-1000 bp) using SEPHACRYL S1000, SEPHAROSE CL2B, or SEPHAROSE CL4B column chromatography (Amersham Pharmacia Biotech) or preparative agarose gel electrophoresis. cDNAs were ligated into compatible restriction enzyme sites of the polylinker of a suitable plasmid, e.g., PBLUESCRIPT plasmid (Stratagene), PSFORT1 plasmid (Life Technologies), PCDNA2.1 plasmid
30 (Invitrogen, Carlsbad CA), PBK-CMV plasmid (Stratagene), or pINCY (Incyte Genomics, Palo Alto CA), or derivatives thereof. Recombinant plasmids were transformed into competent *E. coli* cells including XL1-Blue, XL1-BlueMRF, or SOLR from Stratagene or DH5 α , DH10B, or ElectroMAX DH10B from Life Technologies.

II. Isolation of cDNA Clones

35 Plasmids obtained as described in Example I were recovered from host cells by in vivo

excision using the UNIZAP vector system (Stratagene) or by cell lysis. Plasmids were purified using at least one of the following: a Magic or WIZARD Minipreps DNA purification system (Promega); an AGTC Miniprep purification kit (Edge Biosystems, Gaithersburg MD); and QIAWELL 8 Plasmid, QIAWELL 8 Plus Plasmid, QIAWELL 8 Ultra Plasmid purification systems or the R.E.A.L. PREP 96
5 plasmid purification kit from QIAGEN. Following precipitation, plasmids were resuspended in 0.1 ml of distilled water and stored, with or without lyophilization, at 4°C.

Alternatively, plasmid DNA was amplified from host cell lysates using direct link PCR in a high-throughput format (Rao, V.B. (1994) Anal. Biochem. 216:1-14). Host cell lysis and thermal cycling steps were carried out in a single reaction mixture. Samples were processed and stored in
10 384-well plates, and the concentration of amplified plasmid DNA was quantified fluorometrically using PICOGREEN dye (Molecular Probes, Eugene OR) and a FLUOROSKAN II fluorescence scanner (LabSystems Oy, Helsinki, Finland).

III. Sequencing and Analysis

Incyte cDNA recovered in plasmids as described in Example II were sequenced as follows.
15 Sequencing reactions were processed using standard methods or high-throughput instrumentation such as the ABI CATALYST 800 (Applied Biosystems) thermal cycler or the PTC-200 thermal cycler (MJ Research) in conjunction with the HYDRA microdispenser (Robbins Scientific) or the MICROLAB 2200 (Hamilton) liquid transfer system. cDNA sequencing reactions were prepared using reagents provided by Amersham Pharmacia Biotech or supplied in ABI sequencing kits such as
20 the ABI PRISM BIGDYE Terminator cycle sequencing ready reaction kit (Applied Biosystems). Electrophoretic separation of cDNA sequencing reactions and detection of labeled polynucleotides were carried out using the MEGABACE 1000 DNA sequencing system (Molecular Dynamics); the ABI PRISM 373 or 377 sequencing system (Applied Biosystems) in conjunction with standard ABI protocols and base calling software; or other sequence analysis systems known in the art. Reading
25 frames within the cDNA sequences were identified using standard methods (reviewed in Ausubel, 1997, *supra*, unit 7.7). Some of the cDNA sequences were selected for extension using the techniques disclosed in Example VIII.

The polynucleotide sequences derived from Incyte cDNAs were validated by removing vector, linker, and poly(A) sequences and by masking ambiguous bases, using algorithms and
30 programs based on BLAST, dynamic programming, and dinucleotide nearest neighbor analysis. The Incyte cDNA sequences or translations thereof were then queried against a selection of public databases such as the GenBank primate, rodent, mammalian, vertebrate, and eukaryote databases, and BLOCKS, PRINTS, DOMO, PRODOM, and hidden Markov model (HMM)-based protein family databases such as PFAM. (HMM is a probabilistic approach which analyzes consensus primary
35 structures of gene families. See, for example, Eddy, S.R. (1996) Curr. Opin. Struct. Biol. 6:361-365.)

The queries were performed using programs based on BLAST, FASTA, BLIMPS, and HMMER. The Incyte cDNA sequences were assembled to produce full length polynucleotide sequences.

Alternatively, GenBank cDNAs, GenBank ESTs, stitched sequences, stretched sequences, or Genscan-predicted coding sequences (see Examples IV and V) were used to extend Incyte cDNA assemblages to full length. Assembly was performed using programs based on Phred, Phrap, and Consed, and cDNA assemblages were screened for open reading frames using programs based on GeneMark, BLAST, and FASTA. The full length polynucleotide sequences were translated to derive the corresponding full length polypeptide sequences. Alternatively, a polypeptide of the invention may begin at any of the methionine residues of the full length translated polypeptide. Full length polypeptide sequences were subsequently analyzed by querying against databases such as the GenBank protein databases (genpept), SwissProt, BLOCKS, PRINTS, DOMO, PRODOM, Prosite, and hidden Markov model (HMM)-based protein family databases such as PFAM. Full length polynucleotide sequences are also analyzed using MACDNASIS PRO software (Hitachi Software Engineering, South San Francisco CA) and LASERGENE software (DNASTAR). Polynucleotide and polypeptide sequence alignments are generated using default parameters specified by the CLUSTAL algorithm as incorporated into the MEGALIGN multisequence alignment program (DNASTAR), which also calculates the percent identity between aligned sequences.

Table 7 summarizes the tools, programs, and algorithms used for the analysis and assembly of Incyte cDNA and full length sequences and provides applicable descriptions, references, and threshold parameters. The first column of Table 7 shows the tools, programs, and algorithms used, the second column provides brief descriptions thereof, the third column presents appropriate references, all of which are incorporated by reference herein in their entirety, and the fourth column presents, where applicable, the scores, probability values, and other parameters used to evaluate the strength of a match between two sequences (the higher the score or the lower the probability value, the greater the identity between two sequences).

The programs described above for the assembly and analysis of full length polynucleotide and polypeptide sequences were also used to identify polynucleotide sequence fragments from SEQ ID NO:24-46. Fragments from about 20 to about 4000 nucleotides which are useful in hybridization and amplification technologies are described in Table 4, column 4.

IV. Identification and Editing of Coding Sequences from Genomic DNA

Putative G-protein coupled receptors were initially identified by running the Genscan gene identification program against public genomic sequence databases (e.g., gbpri and gbhtg). Genscan is a general-purpose gene identification program which analyzes genomic DNA sequences from a variety of organisms (See Burge, C. and S. Karlin (1997) J. Mol. Biol. 268:78-94, and Burge, C. and S. Karlin (1998) Curr. Opin. Struct. Biol. 8:346-354). The program concatenates predicted exons to

form an assembled cDNA sequence extending from a methionine to a stop codon. The output of Genscan is a FASTA database of polynucleotide and polypeptide sequences. The maximum range of sequence for Genscan to analyze at once was set to 30 kb. To determine which of these Genscan predicted cDNA sequences encode G-protein coupled receptors, the encoded polypeptides were
5 analyzed by querying against PFAM models for G-protein coupled receptors. Potential G-protein coupled receptors were also identified by homology to Incyte cDNA sequences that had been annotated as G-protein coupled receptors. These selected Genscan-predicted sequences were then compared by BLAST analysis to the genpept and gbprl public databases. Where necessary, the Genscan-predicted sequences were then edited by comparison to the top BLAST hit from genpept to
10 correct errors in the sequence predicted by Genscan, such as extra or omitted exons. BLAST analysis was also used to find any Incyte cDNA or public cDNA coverage of the Genscan-predicted sequences, thus providing evidence for transcription. When Incyte cDNA coverage was available, this information was used to correct or confirm the Genscan predicted sequence. Full length polynucleotide sequences were obtained by assembling Genscan-predicted coding sequences with
15 Incyte cDNA sequences and/or public cDNA sequences using the assembly process described in Example III. Alternatively, full length polynucleotide sequences were derived entirely from edited or unedited Genscan-predicted coding sequences.

V. Assembly of Genomic Sequence Data with cDNA Sequence Data

"Stitched" Sequences

20 Partial cDNA sequences were extended with exons predicted by the Genscan gene identification program described in Example IV. Partial cDNAs assembled as described in Example III were mapped to genomic DNA and parsed into clusters containing related cDNAs and Genscan exon predictions from one or more genomic sequences. Each cluster was analyzed using an algorithm based on graph theory and dynamic programming to integrate cDNA and genomic information,
25 generating possible splice variants that were subsequently confirmed, edited, or extended to create a full length sequence. Sequence intervals in which the entire length of the interval was present on more than one sequence in the cluster were identified, and intervals thus identified were considered to be equivalent by transitivity. For example, if an interval was present on a cDNA and two genomic sequences, then all three intervals were considered to be equivalent. This process allows unrelated
30 but consecutive genomic sequences to be brought together, bridged by cDNA sequence. Intervals thus identified were then "stitched" together by the stitching algorithm in the order that they appear along their parent sequences to generate the longest possible sequence, as well as sequence variants. Linkages between intervals which proceed along one type of parent sequence (cDNA to cDNA or genomic sequence to genomic sequence) were given preference over linkages which change parent
35 type (cDNA to genomic sequence). The resultant stitched sequences were translated and compared

by BLAST analysis to the genpept and gbpri public databases. Incorrect exons predicted by Genscan were corrected by comparison to the top BLAST hit from genpept. Sequences were further extended with additional cDNA sequences, or by inspection of genomic DNA, when necessary.

"Stretched" Sequences

5 Partial DNA sequences were extended to full length with an algorithm based on BLAST analysis. First, partial cDNAs assembled as described in Example III were queried against public databases such as the GenBank primate, rodent, mammalian, vertebrate, and eukaryote databases using the BLAST program. The nearest GenBank protein homolog was then compared by BLAST analysis to either Incyte cDNA sequences or GenScan exon predicted sequences described in
10 Example IV. A chimeric protein was generated by using the resultant high-scoring segment pairs (HSPs) to map the translated sequences onto the GenBank protein homolog. Insertions or deletions may occur in the chimeric protein with respect to the original GenBank protein homolog. The GenBank protein homolog, the chimeric protein, or both were used as probes to search for homologous genomic sequences from the public human genome databases. Partial DNA sequences
15 were therefore "stretched" or extended by the addition of homologous genomic sequences. The resultant stretched sequences were examined to determine whether it contained a complete gene.

VI. Chromosomal Mapping of GCREC Encoding Polynucleotides

The sequences which were used to assemble SEQ ID NO:24-46 were compared with sequences from the Incyte LIFESEQ database and public domain databases using BLAST and other
20 implementations of the Smith-Waterman algorithm. Sequences from these databases that matched SEQ ID NO:24-46 were assembled into clusters of contiguous and overlapping sequences using assembly algorithms such as Phrap (Table 7). Radiation hybrid and genetic mapping data available from public resources such as the Stanford Human Genome Center (SHGC), Whitehead Institute for Genome Research (WIGR), and Génethon were used to determine if any of the clustered sequences
25 had been previously mapped. Inclusion of a mapped sequence in a cluster resulted in the assignment of all sequences of that cluster, including its particular SEQ ID NO., to that map location.

Map locations are represented by ranges, or intervals, of human chromosomes. The map position of an interval, in centiMorgans, is measured relative to the terminus of the chromosome's p-arm. (The centiMorgan (cM) is a unit of measurement based on recombination frequencies between
30 chromosomal markers. On average, 1 cM is roughly equivalent to 1 megabase (Mb) of DNA in humans, although this can vary widely due to hot and cold spots of recombination.) The cM distances are based on genetic markers mapped by Génethon which provide boundaries for radiation hybrid markers whose sequences were included in each of the clusters. Human genome maps and other resources available to the public, such as the NCBI "GeneMap'99" World Wide Web site
35 (<http://www.ncbi.nlm.nih.gov/genemap/>), can be employed to determine if previously identified

disease genes map within or in proximity to the intervals indicated above.

VII. Analysis of Polynucleotide Expression

Northern analysis is a laboratory technique used to detect the presence of a transcript of a gene and involves the hybridization of a labeled nucleotide sequence to a membrane on which RNAs from a particular cell type or tissue have been bound. (See, e.g., Sambrook, supra, ch. 7; Ausubel (1995) supra, ch. 4 and 16.)

Analogous computer techniques applying BLAST were used to search for identical or related molecules in cDNA databases such as GenBank or LIFESEQ (Incyte Genomics). This analysis is much faster than multiple membrane-based hybridizations. In addition, the sensitivity of the computer search can be modified to determine whether any particular match is categorized as exact or similar. The basis of the search is the product score, which is defined as:

$$\frac{\text{BLAST Score} \times \text{Percent Identity}}{5 \times \text{minimum \{length(Seq. 1), length(Seq. 2)\}}}$$

15

The product score takes into account both the degree of similarity between two sequences and the length of the sequence match. The product score is a normalized value between 0 and 100, and is calculated as follows: the BLAST score is multiplied by the percent nucleotide identity and the product is divided by (5 times the length of the shorter of the two sequences). The BLAST score is calculated by assigning a score of +5 for every base that matches in a high-scoring segment pair (HSP), and -4 for every mismatch. Two sequences may share more than one HSP (separated by gaps). If there is more than one HSP, then the pair with the highest BLAST score is used to calculate the product score. The product score represents a balance between fractional overlap and quality in a BLAST alignment. For example, a product score of 100 is produced only for 100% identity over the entire length of the shorter of the two sequences being compared. A product score of 70 is produced either by 100% identity and 70% overlap at one end, or by 88% identity and 100% overlap at the other. A product score of 50 is produced either by 100% identity and 50% overlap at one end, or 79% identity and 100% overlap.

Alternatively, polynucleotide sequences encoding GCREC are analyzed with respect to the tissue sources from which they were derived. For example, some full length sequences are assembled, at least in part, with overlapping Incyte cDNA sequences (see Example III). Each cDNA sequence is derived from a cDNA library constructed from a human tissue. Each human tissue is classified into one of the following organ/tissue categories: cardiovascular system; connective tissue; digestive system; embryonic structures; endocrine system; exocrine glands; genitalia, female; genitalia, male; germ cells; hemic and immune system; liver; musculoskeletal system; nervous

system; pancreas; respiratory system; sense organs; skin; stomatognathic system; unclassified/mixed; or urinary tract. The number of libraries in each category is counted and divided by the total number of libraries across all categories. Similarly, each human tissue is classified into one of the following disease/condition categories: cancer, cell line, developmental, inflammation, neurological, trauma, cardiovascular, pooled, and other, and the number of libraries in each category is counted and divided by the total number of libraries across all categories. The resulting percentages reflect the tissue- and disease-specific expression of cDNA encoding GCREC. cDNA sequences and cDNA library/tissue information are found in the LIFESEQ GOLD database (Incyte Genomics, Palo Alto CA).

VIII. Extension of GCREC Encoding Polynucleotides

Full length polynucleotide sequences were also produced by extension of an appropriate fragment of the full length molecule using oligonucleotide primers designed from this fragment. One primer was synthesized to initiate 5' extension of the known fragment, and the other primer was synthesized to initiate 3' extension of the known fragment. The initial primers were designed using OLIGO 4.06 software (National Biosciences), or another appropriate program, to be about 22 to 30 nucleotides in length, to have a GC content of about 50% or more, and to anneal to the target sequence at temperatures of about 68°C to about 72°C. Any stretch of nucleotides which would result in hairpin structures and primer-primer dimerizations was avoided.

Selected human cDNA libraries were used to extend the sequence. If more than one extension was necessary or desired, additional or nested sets of primers were designed.

High fidelity amplification was obtained by PCR using methods well known in the art. PCR was performed in 96-well plates using the PTC-200 thermal cycler (MJ Research, Inc.). The reaction mix contained DNA template, 200 nmol of each primer, reaction buffer containing Mg^{2+} , $(NH_4)_2SO_4$, and 2-mercaptoethanol, Taq DNA polymerase (Amersham Pharmacia Biotech), ELONGASE enzyme (Life Technologies), and Pfu DNA polymerase (Stratagene), with the following parameters for primer pair PCI A and PCI B: Step 1: 94°C, 3 min; Step 2: 94°C, 15 sec; Step 3: 60°C, 1 min; Step 4: 68°C, 2 min; Step 5: Steps 2, 3, and 4 repeated 20 times; Step 6: 68°C, 5 min; Step 7: storage at 4°C. In the alternative, the parameters for primer pair T7 and SK+ were as follows: Step 1: 94°C, 3 min; Step 2: 94°C, 15 sec; Step 3: 57°C, 1 min; Step 4: 68°C, 2 min; Step 5: Steps 2, 3, and 4 repeated 20 times; Step 6: 68°C, 5 min; Step 7: storage at 4°C.

The concentration of DNA in each well was determined by dispensing 100 μ l PICOGREEN quantitation reagent (0.25% (v/v) PICOGREEN; Molecular Probes, Eugene OR) dissolved in 1X TE and 0.5 μ l of undiluted PCR product into each well of an opaque fluorimeter plate (Corning Costar, Acton MA), allowing the DNA to bind to the reagent. The plate was scanned in a Fluoroskan II (Labsystems Oy, Helsinki, Finland) to measure the fluorescence of the sample and to quantify the concentration of DNA. A 5 μ l to 10 μ l aliquot of the reaction mixture was analyzed by

electrophoresis on a 1 % agarose gel to determine which reactions were successful in extending the sequence.

The extended nucleotides were desalted and concentrated, transferred to 384-well plates, digested with CviJI cholera virus endonuclease (Molecular Biology Research, Madison WI), and sonicated or sheared prior to religation into pUC 18 vector (Amersham Pharmacia Biotech). For
5 shotgun sequencing, the digested nucleotides were separated on low concentration (0.6 to 0.8%) agarose gels, fragments were excised, and agar digested with Agar ACE (Promega). Extended clones were religated using T4 ligase (New England Biolabs, Beverly MA) into pUC 18 vector (Amersham Pharmacia Biotech), treated with Pfu DNA polymerase (Stratagene) to fill-in restriction site
10 overhangs, and transfected into competent *E. coli* cells. Transformed cells were selected on antibiotic-containing media, and individual colonies were picked and cultured overnight at 37°C in 384-well plates in LB/2x carb liquid media.

The cells were lysed, and DNA was amplified by PCR using Taq DNA polymerase (Amersham Pharmacia Biotech) and Pfu DNA polymerase (Stratagene) with the following
15 parameters: Step 1: 94°C, 3 min; Step 2: 94°C, 15 sec; Step 3: 60°C, 1 min; Step 4: 72°C, 2 min; Step 5: steps 2, 3, and 4 repeated 29 times; Step 6: 72°C, 5 min; Step 7: storage at 4°C. DNA was quantified by PICOGREEN reagent (Molecular Probes) as described above. Samples with low DNA recoveries were reamplified using the same conditions as described above. Samples were diluted with 20% dimethylsulfoxide (1:2, v/v), and sequenced using DYENAMIC energy transfer sequencing
20 primers and the DYENAMIC DIRECT kit (Amersham Pharmacia Biotech) or the ABI PRISM BIGDYE Terminator cycle sequencing ready reaction kit (Applied Biosystems).

In like manner, full length polynucleotide sequences are verified using the above procedure or are used to obtain 5' regulatory sequences using the above procedure along with oligonucleotides designed for such extension, and an appropriate genomic library.

25 IX. Labeling and Use of Individual Hybridization Probes

Hybridization probes derived from SEQ ID NO:24-46 are employed to screen cDNAs, genomic DNAs, or mRNAs. Although the labeling of oligonucleotides, consisting of about 20 base pairs, is specifically described, essentially the same procedure is used with larger nucleotide fragments. Oligonucleotides are designed using state-of-the-art software such as OLIGO 4.06
30 software (National Biosciences) and labeled by combining 50 pmol of each oligomer, 250 µCi of [γ -³²P] adenosine triphosphate (Amersham Pharmacia Biotech), and T4 polynucleotide kinase (DuPont NEN, Boston MA). The labeled oligonucleotides are substantially purified using a SEPHADEX G-25 superfine size exclusion dextran bead column (Amersham Pharmacia Biotech). An aliquot containing 10⁷ counts per minute of the labeled probe is used in a typical membrane-based
35 hybridization analysis of human genomic DNA digested with one of the following endonucleases:

Ase I, Bgl II, Eco RI, Pst I, Xba I, or Pvu II (DuPont NEN).

The DNA from each digest is fractionated on a 0.7% agarose gel and transferred to nylon membranes (Nytran Plus, Schleicher & Schuell, Durham NH). Hybridization is carried out for 16 hours at 40°C. To remove nonspecific signals, blots are sequentially washed at room temperature under conditions of up to, for example, 0.1 x saline sodium citrate and 0.5% sodium dodecyl sulfate. Hybridization patterns are visualized using autoradiography or an alternative imaging means and compared.

X. Microarrays

The linkage or synthesis of array elements upon a microarray can be achieved utilizing photolithography, piezoelectric printing (ink-jet printing, See, e.g., Baldeschweiler, supra), mechanical microspotting technologies, and derivatives thereof. The substrate in each of the aforementioned technologies should be uniform and solid with a non-porous surface (Skena (1999), supra). Suggested substrates include silicon, silica, glass slides, glass chips, and silicon wafers. Alternatively, a procedure analogous to a dot or slot blot may also be used to arrange and link elements to the surface of a substrate using thermal, UV, chemical, or mechanical bonding procedures. A typical array may be produced using available methods and machines well known to those of ordinary skill in the art and may contain any appropriate number of elements. (See, e.g., Skena, M. et al. (1995) Science 270:467-470; Shalon, D. et al. (1996) Genome Res. 6:639-645; Marshall, A. and J. Hodgson (1998) Nat. Biotechnol. 16:27-31.)

Full length cDNAs, Expressed Sequence Tags (ESTs), or fragments or oligomers thereof may comprise the elements of the microarray. Fragments or oligomers suitable for hybridization can be selected using software well known in the art such as LASERGENE software (DNASTAR). The array elements are hybridized with polynucleotides in a biological sample. The polynucleotides in the biological sample are conjugated to a fluorescent label or other molecular tag for ease of detection. After hybridization, nonhybridized nucleotides from the biological sample are removed, and a fluorescence scanner is used to detect hybridization at each array element. Alternatively, laser desorption and mass spectrometry may be used for detection of hybridization. The degree of complementarity and the relative abundance of each polynucleotide which hybridizes to an element on the microarray may be assessed. In one embodiment, microarray preparation and usage is described in detail below.

Tissue or Cell Sample Preparation

Total RNA is isolated from tissue samples using the guanidinium thiocyanate method and poly(A)⁺ RNA is purified using the oligo-(dT) cellulose method. Each poly(A)⁺ RNA sample is reverse transcribed using MMLV reverse-transcriptase, 0.05 pg/μl oligo-(dT) primer (21mer), 1X first strand buffer, 0.03 units/μl RNase inhibitor, 500 μM dATP, 500 μM dGTP, 500 μM dTTP, 40

5 μ M dCTP, 40 μ M dCTP-Cy3 (BDS) or dCTP-Cy5 (Amersham Pharmacia Biotech). The reverse transcription reaction is performed in a 25 ml volume containing 200 ng poly(A)⁺ RNA with GEMBRIGHT kits (Incyte). Specific control poly(A)⁺ RNAs are synthesized by in vitro transcription from non-coding yeast genomic DNA. After incubation at 37°C for 2 hr, each reaction sample (one with Cy3 and another with Cy5 labeling) is treated with 2.5 ml of 0.5M sodium hydroxide and incubated for 20 minutes at 85°C to stop the reaction and degrade the RNA. Samples are purified using two successive CHROMA SPIN 30 gel filtration spin columns (CLONTECH Laboratories, Inc. (CLONTECH), Palo Alto CA) and after combining, both reaction samples are ethanol precipitated using 1 ml of glycogen (1 mg/ml), 60 ml sodium acetate, and 300 ml of 100% ethanol. The sample is then dried to completion using a SpeedVAC (Savant Instruments Inc., Holbrook NY) and resuspended in 14 μ l 5X SSC/0.2% SDS.

Microarray Preparation

Sequences of the present invention are used to generate array elements. Each array element is amplified from bacterial cells containing vectors with cloned cDNA inserts. PCR amplification uses primers complementary to the vector sequences flanking the cDNA insert. Array elements are amplified in thirty cycles of PCR from an initial quantity of 1-2 ng to a final quantity greater than 5 μ g. Amplified array elements are then purified using SEPHACRYL-400 (Amersham Pharmacia Biotech).

Purified array elements are immobilized on polymer-coated glass slides. Glass microscope slides (Corning) are cleaned by ultrasound in 0.1% SDS and acetone, with extensive distilled water washes between and after treatments. Glass slides are etched in 4% hydrofluoric acid (VWR Scientific Products Corporation (VWR), West Chester PA), washed extensively in distilled water, and coated with 0.05% aminopropyl silane (Sigma) in 95% ethanol. Coated slides are cured in a 110°C oven.

25 Array elements are applied to the coated glass substrate using a procedure described in US Patent No. 5,807,522, incorporated herein by reference. 1 μ l of the array element DNA, at an average concentration of 100 ng/ μ l, is loaded into the open capillary printing element by a high-speed robotic apparatus. The apparatus then deposits about 5 nl of array element sample per slide.

Microarrays are UV-crosslinked using a STRATALINKER UV-crosslinker (Stratagene). Microarrays are washed at room temperature once in 0.2% SDS and three times in distilled water. Non-specific binding sites are blocked by incubation of microarrays in 0.2% casein in phosphate buffered saline (PBS) (Tropix, Inc., Bedford MA) for 30 minutes at 60°C followed by washes in 0.2% SDS and distilled water as before.

Hybridization

Hybridization reactions contain 9 μ l of sample mixture consisting of 0.2 μ g each of Cy3 and Cy5 labeled cDNA synthesis products in 5X SSC, 0.2% SDS hybridization buffer. The sample mixture is heated to 65°C for 5 minutes and is aliquoted onto the microarray surface and covered with an 1.8 cm² coverslip. The arrays are transferred to a waterproof chamber having a cavity just slightly larger than a microscope slide. The chamber is kept at 100% humidity internally by the addition of 140 μ l of 5X SSC in a corner of the chamber. The chamber containing the arrays is incubated for about 6.5 hours at 60°C. The arrays are washed for 10 min at 45°C in a first wash buffer (1X SSC, 0.1% SDS), three times for 10 minutes each at 45°C in a second wash buffer (0.1X SSC), and dried.

10 **Detection**

Reporter-labeled hybridization complexes are detected with a microscope equipped with an Innova 70 mixed gas 10 W laser (Coherent, Inc., Santa Clara CA) capable of generating spectral lines at 488 nm for excitation of Cy3 and at 632 nm for excitation of Cy5. The excitation laser light is focused on the array using a 20X microscope objective (Nikon, Inc., Melville NY). The slide containing the array is placed on a computer-controlled X-Y stage on the microscope and raster-scanned past the objective. The 1.8 cm x 1.8 cm array used in the present example is scanned with a resolution of 20 micrometers.

In two separate scans, a mixed gas multiline laser excites the two fluorophores sequentially. Emitted light is split, based on wavelength, into two photomultiplier tube detectors (PMT R1477, Hamamatsu Photonics Systems, Bridgewater NJ) corresponding to the two fluorophores. Appropriate filters positioned between the array and the photomultiplier tubes are used to filter the signals. The emission maxima of the fluorophores used are 565 nm for Cy3 and 650 nm for Cy5. Each array is typically scanned twice, one scan per fluorophore using the appropriate filters at the laser source, although the apparatus is capable of recording the spectra from both fluorophores simultaneously.

The sensitivity of the scans is typically calibrated using the signal intensity generated by a cDNA control species added to the sample mixture at a known concentration. A specific location on the array contains a complementary DNA sequence, allowing the intensity of the signal at that location to be correlated with a weight ratio of hybridizing species of 1:100,000. When two samples from different sources (e.g., representing test and control cells), each labeled with a different fluorophore, are hybridized to a single array for the purpose of identifying genes that are differentially expressed, the calibration is done by labeling samples of the calibrating cDNA with the two fluorophores and adding identical amounts of each to the hybridization mixture.

The output of the photomultiplier tube is digitized using a 12-bit RTI-835H analog-to-digital (A/D) conversion board (Analog Devices, Inc., Norwood MA) installed in an IBM-compatible PC computer. The digitized data are displayed as an image where the signal intensity is mapped using a

linear 20-color transformation to a pseudocolor scale ranging from blue (low signal) to red (high signal). The data is also analyzed quantitatively. Where two different fluorophores are excited and measured simultaneously, the data are first corrected for optical crosstalk (due to overlapping emission spectra) between the fluorophores using each fluorophore's emission spectrum.

5 A grid is superimposed over the fluorescence signal image such that the signal from each spot is centered in each element of the grid. The fluorescence signal within each element is then integrated to obtain a numerical value corresponding to the average intensity of the signal. The software used for signal analysis is the GEMTOOLS gene expression analysis program (Incyte).

XI. Complementary Polynucleotides

10 Sequences complementary to the GCREC-encoding sequences, or any parts thereof, are used to detect, decrease, or inhibit expression of naturally occurring GCREC. Although use of oligonucleotides comprising from about 15 to 30 base pairs is described, essentially the same procedure is used with smaller or with larger sequence fragments. Appropriate oligonucleotides are designed using OLIGO 4.06 software (National Biosciences) and the coding sequence of GCREC.

15 To inhibit transcription, a complementary oligonucleotide is designed from the most unique 5' sequence and used to prevent promoter binding to the coding sequence. To inhibit translation, a complementary oligonucleotide is designed to prevent ribosomal binding to the GCREC-encoding transcript.

XII. Expression of GCREC

20 Expression and purification of GCREC is achieved using bacterial or virus-based expression systems. For expression of GCREC in bacteria, cDNA is subcloned into an appropriate vector containing an antibiotic resistance gene and an inducible promoter that directs high levels of cDNA transcription. Examples of such promoters include, but are not limited to, the *trp-lac* (*tac*) hybrid promoter and the T5 or T7 bacteriophage promoter in conjunction with the *lac* operator regulatory

25 element. Recombinant vectors are transformed into suitable bacterial hosts, e.g., BL21(DE3). Antibiotic resistant bacteria express GCREC upon induction with isopropyl beta-D-thiogalactopyranoside (IPTG). Expression of GCREC in eukaryotic cells is achieved by infecting insect or mammalian cell lines with recombinant Autographica californica nuclear polyhedrosis virus (AcMNPV), commonly known as baculovirus. The nonessential polyhedrin gene of baculovirus is

30 replaced with cDNA encoding GCREC by either homologous recombination or bacterial-mediated transposition involving transfer plasmid intermediates. Viral infectivity is maintained and the strong polyhedrin promoter drives high levels of cDNA transcription. Recombinant baculovirus is used to infect Spodoptera frugiperda (Sf9) insect cells in most cases, or human hepatocytes, in some cases. Infection of the latter requires additional genetic modifications to baculovirus. (See Engelhard, E.K.

35 et al. (1994) Proc. Natl. Acad. Sci. USA 91:3224-3227; Sandig, V. et al. (1996) Hum. Gene Ther.

7:1937-1945.)

In most expression systems, GCREC is synthesized as a fusion protein with, e.g., glutathione S-transferase (GST) or a peptide epitope tag, such as FLAG or 6-His, permitting rapid, single-step, affinity-based purification of recombinant fusion protein from crude cell lysates. GST, a 26-kilodalton enzyme from Schistosoma japonicum, enables the purification of fusion proteins on immobilized glutathione under conditions that maintain protein activity and antigenicity (Amersham Pharmacia Biotech). Following purification, the GST moiety can be proteolytically cleaved from GCREC at specifically engineered sites. FLAG, an 8-amino acid peptide, enables immunoaffinity purification using commercially available monoclonal and polyclonal anti-FLAG antibodies (Eastman Kodak). 6-His, a stretch of six consecutive histidine residues, enables purification on metal-chelate resins (QIAGEN). Methods for protein expression and purification are discussed in Ausubel (1995, supra, ch. 10 and 16). Purified GCREC obtained by these methods can be used directly in the assays shown in Examples XVI, XVII, and XVIII, where applicable.

XIII. Functional Assays

GCREC function is assessed by expressing the sequences encoding GCREC at physiologically elevated levels in mammalian cell culture systems. cDNA is subcloned into a mammalian expression vector containing a strong promoter that drives high levels of cDNA expression. Vectors of choice include PCMV SPORT (Life Technologies) and PCR3.1 (Invitrogen, Carlsbad CA), both of which contain the cytomegalovirus promoter. 5-10 μ g of recombinant vector are transiently transfected into a human cell line, for example, an endothelial or hematopoietic cell line, using either liposome formulations or electroporation. 1-2 μ g of an additional plasmid containing sequences encoding a marker protein are co-transfected. Expression of a marker protein provides a means to distinguish transfected cells from nontransfected cells and is a reliable predictor of cDNA expression from the recombinant vector. Marker proteins of choice include, e.g., Green Fluorescent Protein (GFP; Clontech), CD64, or a CD64-GFP fusion protein. Flow cytometry (FCM), an automated, laser optics-based technique, is used to identify transfected cells expressing GFP or CD64-GFP and to evaluate the apoptotic state of the cells and other cellular properties. FCM detects and quantifies the uptake of fluorescent molecules that diagnose events preceding or coincident with cell death. These events include changes in nuclear DNA content as measured by staining of DNA with propidium iodide; changes in cell size and granularity as measured by forward light scatter and 90 degree side light scatter; down-regulation of DNA synthesis as measured by decrease in bromodeoxyuridine uptake; alterations in expression of cell surface and intracellular proteins as measured by reactivity with specific antibodies; and alterations in plasma membrane composition as measured by the binding of fluorescein-conjugated Annexin V protein to the cell surface. Methods in flow cytometry are discussed in Ormerod, M.G. (1994) Flow Cytometry, Oxford, New York NY.

The influence of GCREC on gene expression can be assessed using highly purified populations of cells transfected with sequences encoding GCREC and either CD64 or CD64-GFP. CD64 and CD64-GFP are expressed on the surface of transfected cells and bind to conserved regions of human immunoglobulin G (IgG). Transfected cells are efficiently separated from nontransfected
5 cells using magnetic beads coated with either human IgG or antibody against CD64 (DYNAL, Lake Success NY). mRNA can be purified from the cells using methods well known by those of skill in the art. Expression of mRNA encoding GCREC and other genes of interest can be analyzed by northern analysis or microarray techniques.

XIV. Production of GCREC Specific Antibodies

10 GCREC substantially purified using polyacrylamide gel electrophoresis (PAGE; see, e.g., Harrington, M.G. (1990) *Methods Enzymol.* 182:488-495), or other purification techniques, is used to immunize rabbits and to produce antibodies using standard protocols.

Alternatively, the GCREC amino acid sequence is analyzed using LASERGENE software (DNASTAR) to determine regions of high immunogenicity, and a corresponding oligopeptide is
15 synthesized and used to raise antibodies by means known to those of skill in the art. Methods for selection of appropriate epitopes, such as those near the C-terminus or in hydrophilic regions are well described in the art. (See, e.g., Ausubel, 1995, *supra*, ch. 11.)

Typically, oligopeptides of about 15 residues in length are synthesized using an ABI 431A peptide synthesizer (Applied Biosystems) using Fmoc chemistry and coupled to KLH (Sigma-
20 Aldrich, St. Louis MO) by reaction with N-maleimidobenzoyl-N-hydroxysuccinimide ester (MBS) to increase immunogenicity. (See, e.g., Ausubel, 1995, *supra*.) Rabbits are immunized with the oligopeptide-KLH complex in complete Freund's adjuvant. Resulting antisera are tested for antipeptide and anti-GCREC activity by, for example, binding the peptide or GCREC to a substrate, blocking with 1% BSA, reacting with rabbit antisera, washing, and reacting with radio-iodinated goat
25 anti-rabbit IgG.

XV. Purification of Naturally Occurring GCREC Using Specific Antibodies

Naturally occurring or recombinant GCREC is substantially purified by immunoaffinity chromatography using antibodies specific for GCREC. An immunoaffinity column is constructed by covalently coupling anti-GCREC antibody to an activated chromatographic resin, such as
30 CNBr-activated SEPHAROSE (Amersham Pharmacia Biotech). After the coupling, the resin is blocked and washed according to the manufacturer's instructions.

Media containing GCREC are passed over the immunoaffinity column, and the column is washed under conditions that allow the preferential absorbance of GCREC (e.g., high ionic strength buffers in the presence of detergent). The column is eluted under conditions that disrupt
35 antibody/GCREC binding (e.g., a buffer of pH 2 to pH 3, or a high concentration of a chaotrope, such

as urea or thiocyanate ion), and GCREC is collected.

XVI. Identification of Molecules Which Interact with GCREC

Molecules which interact with GCREC may include agonists and antagonists, as well as molecules involved in signal transduction, such as G proteins. GCREC, or a fragment thereof, is
5 labeled with ¹²⁵I Bolton-Hunter reagent. (See, e.g., Bolton A.E. and W.M. Hunter (1973) *Biochem. J.* 133:529-539.) A fragment of GCREC includes, for example, a fragment comprising one or more of the three extracellular loops, the extracellular N-terminal region, or the third intracellular loop. Candidate molecules previously arrayed in the wells of a multi-well plate are incubated with the labeled GCREC, washed, and any wells with labeled GCREC complex are assayed. Data obtained
10 using different concentrations of GCREC are used to calculate values for the number, affinity, and association of GCREC with the candidate ligand molecules.

Alternatively, molecules interacting with GCREC are analyzed using the yeast two-hybrid system as described in Fields, S. and O. Song (1989) *Nature* 340:245-246, or using commercially available kits based on the two-hybrid system, such as the MATCHMAKER system (Clontech).
15 GCREC may also be used in the PATHCALLING process (CuraGen Corp., New Haven CT) which employs the yeast two-hybrid system in a high-throughput manner to determine all interactions between the proteins encoded by two large libraries of genes (Nandabalan, K. et al. (2000) U.S. Patent No. 6,057,101).

Potential GCREC agonists or antagonists may be tested for activation or inhibition of
20 GCREC receptor activity using the assays described in sections XVII and XVIII. Candidate molecules may be selected from known GPCR agonists or antagonists, peptide libraries, or combinatorial chemical libraries.

Methods for detecting interactions of GCREC with intracellular signal transduction molecules such as G proteins are based on the premise that internal segments or cytoplasmic domains
25 from an orphan G protein-coupled seven transmembrane receptor may be exchanged with the analogous domains of a known G protein-coupled seven transmembrane receptor and used to identify the G-proteins and downstream signaling pathways activated by the orphan receptor domains (Kobilka, B.K. et al. (1988) *Science* 240:1310-1316). In an analogous fashion, domains of the orphan receptor may be cloned as a portion of a fusion protein and used in binding assays to demonstrate
30 interactions with specific G proteins. Studies have shown that the third intracellular loop of G protein-coupled seven transmembrane receptors is important for G protein interaction and signal transduction (Conklin, B.R. et al. (1993) *Cell* 73:631-641). For example, the DNA fragment corresponding to the third intracellular loop of GCREC may be amplified by the polymerase chain reaction (PCR) and subcloned into a fusion vector such as pGEX (Pharmacia Biotech). The construct
35 is transformed into an appropriate bacterial host, induced, and the fusion protein is purified from the

cell lysate by glutathione-Sepharose 4B (Pharmacia Biotech) affinity chromatography.

For in vitro binding assays, cell extracts containing G proteins are prepared by extraction with 50 mM Tris, pH 7.8, 1 mM EGTA, 5 mM MgCl₂, 20 mM CHAPS, 20% glycerol, 10 µg of both aprotinin and leupeptin, and 20 µl of 50 mM phenylmethylsulfonyl fluoride. The lysate is incubated
5 on ice for 45 min with constant stirring, centrifuged at 23,000 g for 15 min at 4°C, and the supernatant is collected. 750 µg of cell extract is incubated with glutathione S-transferase (GST) fusion protein beads for 2 h at 4°C. The GST beads are washed five times with phosphate-buffered saline. Bound G subunits are detected by [³²P]ADP-ribosylation with pertussis or cholera toxins. The reactions are terminated by the addition of SDS sample buffer (4.6% (w/v) SDS, 10% (v/v)
10 β-mercaptoethanol, 20% (w/v) glycerol, 95.2 mM Tris-HCl, pH 6.8, 0.01% (w/v) bromphenol blue). The [³²P]ADP-labeled proteins are separated on 10% SDS-PAGE gels, and autoradiographed. The separated proteins in these gels are transferred to nitrocellulose paper, blocked with blotto (5% nonfat dried milk, 50 mM Tris-HCl (pH 8.0), 2 mM CaCl₂, 80 mM NaCl, 0.02% NaN₃, and 0.2% Nonidet P-40) for 1 hour at room temperature, followed by incubation for 1.5 hours with Gα subtype selective
15 antibodies (1:500; Calbiochem-Novabiochem). After three washes, blots are incubated with horseradish peroxidase (HRP)-conjugated goat anti-rabbit immunoglobulin (1:2000, Cappel, Westchester PA) and visualized by the chemiluminescence-based ECL method (Amersham Corp.).

XVII. Demonstration of GCREC Activity

An assay for GCREC activity measures the expression of GCREC on the cell surface. cDNA
20 encoding GCREC is transfected into an appropriate mammalian cell line. Cell surface proteins are labeled with biotin as described (de la Fuente, M.A. et al. (1997) Blood 90:2398-2405). Immunoprecipitations are performed using GCREC-specific antibodies, and immunoprecipitated samples are analyzed using sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and immunoblotting techniques. The ratio of labeled immunoprecipitant to unlabeled
25 immunoprecipitant is proportional to the amount of GCREC expressed on the cell surface.

In the alternative, an assay for GCREC activity is based on a prototypical assay for ligand/receptor-mediated modulation of cell proliferation. This assay measures the rate of DNA synthesis in Swiss mouse 3T3 cells. A plasmid containing polynucleotides encoding GCREC is added to quiescent 3T3 cultured cells using transfection methods well known in the art. The
30 transiently transfected cells are then incubated in the presence of [³H]thymidine, a radioactive DNA precursor molecule. Varying amounts of GCREC ligand are then added to the cultured cells. Incorporation of [³H]thymidine into acid-precipitable DNA is measured over an appropriate time interval using a radioisotope counter, and the amount incorporated is directly proportional to the amount of newly synthesized DNA. A linear dose-response curve over at least a hundred-fold
35 GCREC ligand concentration range is indicative of receptor activity. One unit of activity per

milliliter is defined as the concentration of GCREC producing a 50% response level, where 100% represents maximal incorporation of [³H]thymidine into acid-precipitable DNA (McKay, I. and I. Leigh, eds. (1993) Growth Factors: A Practical Approach, Oxford University Press, New York NY, p. 73.)

5 In a further alternative, the assay for GCREC activity is based upon the ability of GPCR family proteins to modulate G protein-activated second messenger signal transduction pathways (e.g., cAMP; Gaudin, P. et al. (1998) *J. Biol. Chem.* 273:4990-4996). A plasmid encoding full length GCREC is transfected into a mammalian cell line (e.g., Chinese hamster ovary (CHO) or human embryonic kidney (HEK-293) cell lines) using methods well-known in the art. Transfected cells are
10 grown in 12-well trays in culture medium for 48 hours, then the culture medium is discarded, and the attached cells are gently washed with PBS. The cells are then incubated in culture medium with or without ligand for 30 minutes, then the medium is removed and cells lysed by treatment with 1 M perchloric acid. The cAMP levels in the lysate are measured by radioimmunoassay using methods well-known in the art. Changes in the levels of cAMP in the lysate from cells exposed to ligand
15 compared to those without ligand are proportional to the amount of GCREC present in the transfected cells.

To measure changes in inositol phosphate levels, the cells are grown in 24-well plates containing 1×10^5 cells/well and incubated with inositol-free media and [³H]myoinositol, 2 μ Ci/well, for 48 hr. The culture medium is removed, and the cells washed with buffer containing 10 mM LiCl
20 followed by addition of ligand. The reaction is stopped by addition of perchloric acid. Inositol phosphates are extracted and separated on Dowex AG1-X8 (Bio-Rad) anion exchange resin, and the total labeled inositol phosphates counted by liquid scintillation. Changes in the levels of labeled inositol phosphate from cells exposed to ligand compared to those without ligand are proportional to the amount of GCREC present in the transfected cells.

25 XVIII. Identification of GCREC Ligands

GCREC is expressed in a eukaryotic cell line such as CHO (Chinese Hamster Ovary) or HEK (Human Embryonic Kidney) 293 which have a good history of GPCR expression and which contain a wide range of G-proteins allowing for functional coupling of the expressed GCREC to downstream effectors. The transformed cells are assayed for activation of the expressed receptors in the presence
30 of candidate ligands. Activity is measured by changes in intracellular second messengers, such as cyclic AMP or Ca²⁺. These may be measured directly using standard methods well known in the art, or by the use of reporter gene assays in which a luminescent protein (e.g. firefly luciferase or green fluorescent protein) is under the transcriptional control of a promoter responsive to the stimulation of protein kinase C by the activated receptor (Milligan, G. et al. (1996) *Trends Pharmacol. Sci.* 17:235-
35 237). Assay technologies are available for both of these second messenger systems to allow high

throughput readout in multi-well plate format, such as the adenylyl cyclase activation FlashPlate Assay (NEN Life Sciences Products), or fluorescent Ca^{2+} indicators such as Fluo-4 AM (Molecular Probes) in combination with the FLIPR fluorimetric plate reading system (Molecular Devices). In cases where the physiologically relevant second messenger pathway is not known, GCREC may be

5 coexpressed with the G-proteins $\text{G}_{\alpha 15/16}$ which have been demonstrated to couple to a wide range of G-proteins (Offermanns, S. and M.I. Simon (1995) J. Biol. Chem. 270:15175-15180), in order to funnel the signal transduction of the GCREC through a pathway involving phospholipase C and Ca^{2+} mobilization. Alternatively, GCREC may be expressed in engineered yeast systems which lack endogenous GPCRs, thus providing the advantage of a null background for GCREC activation

10 screening. These yeast systems substitute a human GPCR and G_α protein for the corresponding components of the endogenous yeast pheromone receptor pathway. Downstream signaling pathways are also modified so that the normal yeast response to the signal is converted to positive growth on selective media or to reporter gene expression (Broach, J.R. and J. Thorner (1996) Nature 384 (supp.):14-16). The receptors are screened against putative ligands including known GPCR ligands

15 and other naturally occurring bioactive molecules. Biological extracts from tissues, biological fluids and cell supernatants are also screened.

Various modifications and variations of the described methods and systems of the invention will be apparent to those skilled in the art without departing from the scope and spirit of the

20 invention. Although the invention has been described in connection with certain embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the described modes for carrying out the invention which are obvious to those skilled in molecular biology or related fields are intended to be within the scope of the following claims.

Table 1

Incyte Project ID	Polypeptide SEQ ID NO:	Incyte Polypeptide ID	Polynucleotide SEQ ID NO:	Incyte Polynucleotide ID
7475208	1	7475208CD1	24	7475208CB1
7475101	2	7475101CD1	25	7475101CB1
7475152	3	7475152CD1	26	7475152CB1
7475164	4	7475164CD1	27	7475164CB1
7475170	5	7475170CD1	28	7475170CB1
7475197	6	7475197CD1	29	7475197CB1
7475210	7	7475210CD1	30	7475210CB1
7475221	8	7475221CD1	31	7475221CB1
7475244	9	7475244CD1	32	7475244CB1
7475293	10	7475293CD1	33	7475293CB1
7475297	11	7475297CD1	34	7475297CB1
7475193	12	7475193CD1	35	7475193CB1
7475213	13	7475213CD1	36	7475213CB1
7475272	14	7475272CD1	37	7475272CB1
7475200	15	7475200CD1	38	7475200CB1
7475121	16	7475121CD1	39	7475121CB1
7475165	17	7475165CD1	40	7475165CB1
7475273	18	7475273CD1	41	7475273CB1
7476077	19	7476077CD1	42	7476077CB1
7476113	20	7476113CD1	43	7476113CB1
7476117	21	7476117CD1	44	7476117CB1
7476079	22	7476079CD1	45	7476079CB1
7476112	23	7476112CD1	46	7476112CB1

Table 2

Polypeptide SEQ ID NO:	Incyte Polypeptide ID	GenBank ID NO:	Probability Score	GenBank Homolog
1	7475208CD1	g12745520 g683747	7.00E-91 4.00E-73	Putative sweet taste receptor T1R1 [Mus musculus] Extracellular calcium-sensing receptor [Homo sapiens]
2	7475101CD1	g1256389	5.70E-95	Taste bud receptor protein TB 334 [Rattus norvegicus] (Thomas, M.B. et al. (1996) Gene 178:1-5)
3	7475152CD1	g2370145	2.30E-82	Olfactory receptor protein [Homo sapiens] (Bernot, A. et al. (1997) Nat. Genet. 17:25-31)
4	7475164CD1	g11692559	1.00E-141	Odorant receptor K42 [Mus musculus]
5	7475170CD1	g12054409	1.00E-107	Olfactory receptor [Homo sapiens]
6	7475197CD1	g2808658	1.60E-90	Olfactory receptor [Homo sapiens] (Bernot, A. et al. (1998) Genomics 50:147-160)
7	7475210CD1	g1256389	3.90E-135	Taste bud receptor protein TB 334 [Rattus norvegicus] (Thomas, M.B. et al. (1996) Gene 178:1-5)
8	7475221CD1	g6178008	2.10E-104	Odorant receptor MOR18 [Mus musculus] (Tsuboi, A. et al. (1999) J. Neurosci. 19:8409-8418)
9	7475244CD1	g3831598	2.90E-84	Olfactory receptor [Homo sapiens] (Buettner, J.A. et al. (1998) Genomics 53:56-68)
10	7475293CD1	g6090787	2.10E-104	Olfactory receptor [Pan troglodytes] (Sharon, D. et al. (1999) Genomics 61:24-36)
11	7475297CD1	g6178008	3.60E-100	Odorant receptor MOR18 [Mus musculus] (Tsuboi, A. et al. (1999) J. Neurosci. 19:8409-8418)
12	7475193CD1	g6178006	4.60E-84	Odorant receptor MOR83 [Mus musculus] (Tsuboi, A. et al. (1999) J. Neurosci. 19:8409-8418)
13	7475213CD1	g1419016	9.70E-139	Odorant receptor [Mus musculus] (Asai, H. et al. (1996) Biochem. Biophys. Res. Commun. 221:240-247)
14	7475272CD1	g3746448	4.70E-75	Olfactory receptor OR93Gib [Hylobates lar] (Rouquier, S. et al. (1998) Hum. Mol. Genet. 7:1337-1345)

Table 2 (cont.)

Polypeptide SEQ ID NO:	Incyte Polypeptide ID	GenBank ID NO:	Probability Score	GenBank Homolog
15	7475200CD1	g6178008	4.60E-138	Odorant receptor MOR18 [Mus musculus] (Tsuboi, A. et al. (1999) J. Neurosci. 19:8409-8418)
16	7475121CD1	g39833392	2.70E-85	Olfactory receptor F6 [Mus musculus] (Krautwurst, D. et al. (1998) Cell 95:917-926)
17	7475165CD1	g7211257	1.20E-109	Olfactory receptor [Gorilla gorilla] (Rouquier, S. et al. (2000) Proc. Natl. Acad. Sci. USA 97:2870-2874)
18	7475273CD1	g1314663	4.10E-82	CfOLF2 [Canis familiaris] (Issel-Tarver, L. and J. Rine (1996) Proc. Natl. Acad. Sci. USA 93:10879-10902)
19	7476077CD1	g6532001	1.40E-88	Odorant receptor S19 [Mus musculus]
20	7476113CD1	g1336041	9.30E-92	HsOLF1 [Homo sapiens]
21	7476117CD1	g1336041	2.50E-82	HsOLF1 [Homo sapiens]
22	7476079CD1	g12704541	1.00E-126	Olfactory receptor S83 [Mus musculus]
23	7476112CD1	g39833392	4.00E-100	Olfactory receptor F6 [Mus musculus] (Krautwurst, D. et al. (1998) Cell 95:917-926)

Table 3

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
1	7475208CD1	855	S203 S217 S242 S308 S312 S477 S539 S562 S570 S678 S744 T102 T153 T480 T852	N130 N283 N304 N411 N432 N475 N85	G-PROTEIN COUPLED RECEPTORS FAMILY 3 DM00837 I59362 1-893; N411-E841 G-protein coupled receptor BL009791: P506-H526 Metabotropic glutamate receptor signature PR00248: K32-G44, G69-N84, N84-C103, V141-P167, L202-Q221, Q221-V237, V237-F254, A692-P715 Transmembrane domain: L581-F601, L617-F635, A692-L711 G-protein coupled receptors family 3 signature 2: C528-C552	BLAST-DOMO BLIMPS-BLOCKS BLIMPS-PRINTS HMMER MOTIFS
2	7475101CD1	330	T25 S84 T285 S308 S324	N22 N82	Transmembrane domains: P42-L64; I109-M135; L214-F233 7 transmembrane receptor (rhodopsin family) domain: G58-Y307 G-protein coupled receptors signature BL00237: Q107-P146; L224-Y235; I299-K315 G-protein coupled receptors signature: Y119-V164 Olfactory receptor signature PR00245: M76-K97; F194-D208; F255-G270; A291-L302; S308-F322 Rhodopsin-like GPCR superfamily signature PR00237: L43-S67; M76-K97; L121-I143; L157-L178; I216-F239; A254-L278; S289-K315 RECEPTOR OLFACTORY RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: V183-L262 G-PROTEIN COUPLED RECEPTORS DM00013 P23266 17-306: L34-L321 G-protein coupled receptors motif: L127-I143	HMMER HMMER-PFAM BLIMPS-BLOCKS PROFILES CAN BLIMPS-PRINTS BLIMPS-PRINTS BLAST-PRODOM BLAST-DOMO MOTIFS

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
3	7475152CD1	324	S19 S67 S93 T267 S18 S87 S290 S315 T318	N5 N276	Signal peptide: M1-S21	HMMER
					Transmembrane domain: L30-I46	HMMER
					7 transmembrane receptor (rhodopsin family) domain: G41-Y289	HMMER-PFAM
					G-protein coupled receptors signature BL00237: K90-P129; V207-Y218; T281-K297	BLIMPS-BLOCKS
					G-protein coupled receptors signature: Y102-F147	PROFILES SCAN
					Olfactory receptor signature PR00245: M59-K80; F177-S191; F238-G253; A273-L284; S290-I304	BLIMPS-PRINTS
					Rhodopsin-like GPCR superfamily signature PR00237: P26-H50; M59-K80; F104-I126; A199-L222; R271-K297	BLIMPS-PRINTS
4	7475164CD1	374	T368 T44 S130 S156 T179 T329 S14 T81 T141 S200 T223 S354		RECEPTOR OLFACTORY RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L166-L245	BLAST-PRODROM
					G-PROTEIN COUPLED RECEPTORS DM00013 P23266 17-306: L17-I304	BLAST-DOMO
					G-protein coupled receptors motif: I110-I126	MOTIFS
					Transmembrane domains: F91-L111; I260-I279	HMMER
					7 transmembrane receptor (rhodopsin family) domain: G104-I265; S338-Y353	HMMER-PFAM
					G-protein coupled receptors signature BL00237: N153-P192; I345-K361	BLIMPS-BLOCKS
					G-protein coupled receptors signature: Y165-S213	PROFILES SCAN

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
4					Olfactory receptor signature PR00245: V122-K143; Y240-S254; F301-G316; S337-L348; S354-T368 Rhodopsin-like GPCR superfamily signature PR00237: P89-A113; V122-K143; F167-I189; L262-F285; K335-K361 RECEPTOR OLFATORY RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L229-L309	BLIMPS- PRINTS BLIMPS- PRINTS BLAST- PRODOM
5	7475170CD1	312	S49 S67 T193 S18 T291	N5 N42 N65 N195 N265	G-PROTEIN COUPLED RECEPTORS DM00013 S51356 18-307: L80-T368 Transmembrane domains: L23-G41; M59-L82; C97-M118; F200-F216 7 transmembrane receptor (rhodopsin family) domain: G41-Y290 G-protein coupled receptors signature BL00237: K90-P129; L207-Y218; T282-K298 Olfactory receptor signature PR00245: M59-Q80; F177-D191; F238-G253; I274-I285; T291-L305 OLFATORY RECEPTOR RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD149621: T246-Y309 G-PROTEIN COUPLED RECEPTORS DM00013 P23275 17-306: S18-L305	BLAST-DOMO HMMER HMMER-PFAM BLIMPS- BLOCKS BLIMPS- PRINTS BLAST- PRODOM BLAST-DOMO

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
6	7475197CD1	325	S323 T21 S80 S201 T278 T283 S304	N18 N78 N144	Signal peptide: M1-G54 Transmembrane domains: L43-I59; V211-F229 7 transmembrane receptor (rhodopsin family) domain: G54-Y303 G-protein coupled receptors signature BL00237: Q103-P142; I220-Y231; T295-K311 Olfactory receptor signature PR00245: M72-K93; F190-D204; F251-G266; G287-I298; S304-I318 RECEPTOR OLFACTORY RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L179-L258 G-PROTEIN COUPLED RECEPTORS DM00013 P23266 17-306: K32-I318 Transmembrane domains: I28-I44; M195-T214 7 transmembrane receptor (rhodopsin family) domain: G39-Y288 G-protein coupled receptors signature BL00237: H88-P127; L205-Y216; T280-K296 G-protein coupled receptors signature: Y100-L145 Olfactory receptor signature PR00245: M57-K78; F175-D189; F236-G251; A272-L283; S289-F303 Rhodopsin-like GPCR superfamily signature PR00237: S24-G48; M57-K78; F102-I124; V138-F159; V197-V220; A235-C259; I270-K296	SPSCAN HMMER HMMER-PFAM BLIMPS-BLOCKS BLIMPS-PRINTS BLAST-PRODOM BLAST-DOMO HMMER HMMER-PFAM BLIMPS-BLOCKS PROFILES SCAN BLIMPS-PRINTS BLIMPS-PRINTS
7	7475210CD1	311	S6 S65 S186 S289 S304	N3 N63		

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
7					RECEPTOR OLFACTORY PROTEIN RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L164-L243 G-PROTEIN COUPLED RECEPTORS DM00013 P23266 17-306: I15-S304 G-protein coupled receptors motif: L108-I124	BLAST- PRODOM BLAST-DOMO MOTIFS
8	7475221CD1	344	S335 T25 S95 S115 S252 T316 S331	N36 N290	Transmembrane domain: V54-V75 7 transmembrane receptor (rhodopsin family) domain: G69-Y315 G-protein coupled receptors signature BL00237: K118-P157; E259-L285; T307-K323 G-protein coupled receptors signature: F130-A175 Olfactory receptor signature PR00245: M87-K108; F205-N219; F265-V280; M299-L310; T316-W330 Rhodopsin-like GPCR superfamily signature PR00237: V54-W78; M87-K108; D132-I154; V168-L189; M227-L250; A264-R288; K297-K323 RECEPTOR OLFACTORY RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L194-V272 G-PROTEIN COUPLED RECEPTORS DM00013 S29710 15-301: L45-W330 G-protein coupled receptors motif: A138-I154	HMMER HMMER-PFAM BLIMPS- BLOCKS PROFILES SCAN BLIMPS- PRINTS BLIMPS- PRINTS BLAST- PRODOM BLAST-DOMO MOTIFS

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
9	7475244CD1	313	S68 S168 S189 S3 T79 S138 S196 S233 S292	N6	<p>Transmembrane domains: F29-I49; I93-M119; L199-T225</p> <p>7 transmembrane receptor (rhodopsin family) domain: G42-Y291</p> <p>G-protein coupled receptors signature BL00237: R91-P130; I283-N299</p> <p>G-protein coupled receptors signature: F104-G153</p> <p>Olfactory receptor signature PR00245: M60-K81; F178-D192; F239-G254; A275-L286; S292-V306</p> <p>RECEPTOR OLFACTORY RECEPTORLIKE</p> <p>GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L167-L246</p> <p>G-PROTEIN COUPLED RECEPTORS DM00013 S51316 18-307: S19-V307</p> <p>G-protein coupled receptors motif: T111-V127</p>	<p>HMMER</p> <p>HMMER-PFAM</p> <p>BLIMPS-BLOCKS</p> <p>PROFILES SCAN</p> <p>BLIMPS-PRINTS</p> <p>BLAST-PRODOM</p> <p>BLAST-DOMO</p> <p>MOTIFS</p>
10	7475293CD1	313	S8 T108 S188 S193 S268 S230 S268 S291	N5	<p>Transmembrane domains: L30-I46; V198-I216</p> <p>7 transmembrane receptor (rhodopsin family) domain: G41-Y290</p> <p>G-protein coupled receptors signature BL00237: Q90-P129; I207-Y218; T282-K298</p> <p>G-protein coupled receptors signature: Y102-V147</p> <p>Olfactory receptor signature PR00245: M59-K80; F177-D191; L238-G253; A274-L285; S291-F305</p> <p>RECEPTOR OLFACTORY RECEPTORLIKE</p> <p>GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L166-L245</p>	<p>HMMER</p> <p>HMMER-PFAM</p> <p>BLIMPS-BLOCKS</p> <p>PROFILES SCAN</p> <p>BLIMPS-PRINTS</p> <p>BLAST-PRODOM</p>

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
10					G-PROTEIN COUPLED RECEPTORS DM00013 P30953 18-306: P18-N306 G-protein coupled receptors motif: L110-I126	BLAST-DOMO MOTIFS
11	7475297CD1	309	T36 S65 S52 S91 S135 S222 S227 T286	N6	Signal peptide: M1-R54 Transmembrane domains: V28-V44; M57-A76; M204-L220 7 transmembrane receptor (rhodopsin family) domain: E39-Y285 G-protein coupled receptors signature BL00237: T88-P127; T277-K293 G-protein coupled receptors signature: F100-G144 Olfactory receptor signature PR00245: M57-K78; F175-D189; L235-V250; M269-L280; T286-W300 Rhodopsin-like GPCR superfamily signature PR00237: I24-I48; M57-K78; E102-I124; V138-L159; V197-L220; A234-R258; K267-K293 RECEPTOR OLFACTORY RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: I164-L242 G-PROTEIN COUPLED RECEPTORS DM00013 S29710 15-301: L15-W300 G-protein coupled receptors motif: V108-I124	SPSCAN HMMER HMMER-PFAM BLIMPS-BLOCKS PROFILESCAN BLIMPS-PRINTS BLIMPS-PRINTS BLAST-PRODROM BLAST-DOMO MOTIFS
12	7475193CD1	313	S229 T77 T192 S148 T235 T290	N5	Transmembrane domains: V26-I45; I200-A219 7 transmembrane receptor (rhodopsin family) domain: G41-Y289 G-protein coupled receptors signature BL00237: K90-P129; F281-K297	HMMER HMMER-PFAM BLIMPS-BLOCKS

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
12					<p>Olfactory receptor signature PR00245: M59-E80; Y177-N191; M239-G254; V273-R284; T290-V304</p> <p>Rhodopsin-like GPCR superfamily signature PR00237: V26-S50; M59-E80; L104-I126; K271-K297</p> <p>OLFACTORY RECEPTOR RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD194621: T247-V304</p>	BLIMPS-PRINTS BLIMPS-PRINTS BLAST-PRODROM
13	7475213CD1	342	T236 T171 S187 T192 S265 S309 S290	N5	<p>G-PROTEIN COUPLED RECEPTORS DM00013 S29710 15-301: L17-L303</p> <p>Transmembrane domains: L27-C50; I196-L219</p> <p>7 transmembrane receptor (rhodopsin family) domain: A41-Y289</p> <p>G-protein coupled receptors signature BL00237: Q90-P129; I206-Y217; T281-Q297</p> <p>G-protein coupled receptors signature: F102-G147</p> <p>Olfactory receptor signature PR00245: M59-R80; F176-D190; F237-G252; L273-L284; S290-L304</p> <p>RECEPTOR OLFACTORY RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L166-L244</p> <p>G-PROTEIN COUPLED RECEPTORS DM00013 P30954 29-316: S18-L300</p>	BLAST-DOMO HMMER HMMER-PFAM BLIMPS-BLOCKS PROFILES SCAN BLIMPS-PRINTS BLAST-PRODROM BLAST-DOMO

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
14	7475272CD1	310	S172 T188 S267 S290	N5	Signal peptide: M1-G41 Transmembrane domains: F28-L48; F202-M226 7 transmembrane receptor (rhodopsin family) domain: G41-Y289 G-protein coupled receptors signature BL00237: A90-P129; I281-K297 G-protein coupled receptors signature: F102-A146 Olfactory receptor signature PR00245: M59-Q80; I177-E191; F237-G252; V273-L284; S290-L304 Rhodopsin-like GPCR superfamily signature PR00237: P26-L50; M59-Q80; F104-V126; I199-I222; R271-K297 OLFACTORY RECEPTOR RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD149621: T245-R306 G-PROTEIN COUPLED RECEPTORS DM00013 S51356 18-307: T18-L300 G-protein coupled receptors motif: I110-V126 signal cleavage: M1-A54 transmembrane domain: V27-L53, L196-L223 7 transmembrane receptor (rhodopsin family) 7tm_1: G39-Y285 G-protein coupled receptor BL00237A: R88-P127, BL00237D: T277-K293	SPSCAN HMME HMME-PFAM BLIMPS-BLOCKS PROFILESCAN BLIMPS-PRINTS BLIMPS-PRINTS BLAST-PRODOR BLAST-DOMO MOTIFS SPSCAN HMME HMME-PFAM BLIMPS-BLOCKS
15	7475200CD1	302	S222 S65 S83 T286 Y85	N130 N6 N63		

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
15					<p>Olfactory receptor signature PR00245A: V57-K78, PR00245B: F175-N189, PR00245C: L235-V250, PR00245D: M269-L280, PR00245E: T286-F300</p> <p>Rhodopsin-like GPCR superfamily signature PR00237A: V24-T48, PR00237B: V57-K78, PR00237C: A102-I124, PR00237D: L138-L159, PR00237E: V197-L220, PR00237F: A234-H258, PR00237G: K267-K293</p> <p>G-protein coupled receptors signature: A102-V145 G-Protein_Receptor: V108-I124 G-PROTEIN COUPLED RECEPTORS DM00013 S29710 15-301: L15-F300, DM00013 P23266 17-306: L15-L299, DM00013 P37067 17-306: L15-L299, DM00013 P23270 18-311: V24-K298</p> <p>RECEPTOR OLFACTORY RECEPTOR LIKE G-PROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L164-I243</p>	BLIMPS-PRINTS
					<p>PROFILES CAN</p> <p>MOTIFS BLAST-DOMO</p>	BLIMPS-PRINTS
16	7475121CD1	316	S68, T79, S138, S293	N5, N192	<p>G-PROTEIN COUPLED RECEPTORS: DM00013 P30954 29-316: S18-I303</p> <p>OLFACTORY RECEPTOR-LIKE G-PROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN, MULTIGENE FAMILY: PD000921: L167-L247</p> <p>G-protein coupled receptor: BL00237A: H91-P130; BL00237C: T284-K300</p>	BLAST-DOMO BLAST-PRODOM BLIMPS-BLOCKS

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
16					<p>Olfactory receptor signature: PR00245A: M60-R81; PR00245B: F178-N192; PR00245C: F240-S255; PR00245D: M276-L287; PR00245E: S293-F307</p> <p>EDG1 orphan receptor signature: PR00642D: T49-F63</p> <p>G-protein coupled receptors signature: F103-T149</p> <p>Transmembrane domain: I27-L45, M102-Y121, V204-V224</p> <p>7-Transmembrane receptor (rhodopsin family; 7tm_1): G42-F292</p>	BLIMPS-PRINTS
17	7475165CD1	370	S125 S288 S349 S364 S57 T225 T228 T35 T46 T52 Y152	N123 N63	<p>G-PROTEIN COUPLED RECEPTORS: DM00013 P23265 17-306: D77-L363</p> <p>OLFACTORY RECEPTOR-LIKE G-PROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD149621: V305-R365</p> <p>G-protein coupled receptor BL00237D: T340-K356; K148-P187</p> <p>Olfactory receptor signature: PR00245A: M117-K138; PR00245B: F235-N249; PR00245C: F296-G311; PR00245D: A332-L343; PR00245E: S349-L363</p> <p>G-protein coupled receptors signature: Y160-A205</p> <p>Transmembrane domain: L88-I104; M117-L140; M194-F213; I255-Y276</p> <p>7-transmembrane receptor (rhodopsin family; 7tm_1): G99-Y348</p> <p>G Protein Receptor motif: M168-I184</p>	<p>BLIMPS-PRINTS</p> <p>BLIMPS-PRINTS</p> <p>PROFILES-SCAN</p> <p>HMMER</p> <p>HMMER-PFAM</p> <p>BLAST-DOMO</p> <p>BLAST-PRODROM</p> <p>BLIMPS-BLOCKS</p> <p>BLIMPS-PRINTS</p> <p>PROFILES-SCAN</p> <p>HMMER</p> <p>HMMER-PFAM</p> <p>MOTIFS</p>

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
18	7475273CD1	318	S65, T84, S135, S186, S266, S289, S298, T316	N3, N144	G-PROTEIN COUPLED RECEPTORS: DM00013 S51356 18-307:T16-M299 OLFACTORY RECEPTOR-LIKE G-PROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN, MULTIGENE FAMILY: PD149621:T244-K305 G-protein coupled receptor: BL00237A: K88-P127; BL00237D: I280-K296 Olfactory receptor signature: PR00245A: M57-N78; PR00245B: V175-D189; PR00245C: F236-G251; PR00245D: V272-L283; PR00245E: S289-F303 EDG1 orphan receptor signature: PR00642D: V46-F60 Transmembrane (transmem_domain): T23-V46; I90-M116; L195-L221 7-transmembrane receptor motif (rhodopsin family; 7tm_1): G39-V138; I209-Y288 G-Protein Receptor: T108-I124 G-Protein Coupled Receptor Signature: F100-I143 Transmembrane domain: L27-E54 7 transmembrane receptor (rhodopsin family) domain: G43-Y294 G-protein coupled receptors signature BL00237: G92-P131; E234-S260; P286-R302 G-protein coupled receptors signature: F104-R153 Rhodopsin-like GPCR superfamily signature PR00237: W28-A52; V61-K82; I106-I128; A239-T263; I276-R302	BLAST-DOMO BLAST-PRODROM BLIMPS-BLOCKS BLIMPS-PRINTS BLIMPS-PRINTS HMMER HMMER-PFAM MOTIFS PROFILES SCAN HMMER HMMER-PFAM BLIMPS-BLOCKS PROFILES SCAN BLIMPS-PRINTS
19	7476077CD1	321	S231 S69 T179 T263 T7	N44 N5		

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
19					Olfactory receptor signature PR00245: V61-K82; T179-D193; L240-T255 PUTATIVE GPROTEIN COUPLED RECEPTOR RA1C PD170483: V249-A319 G-PROTEIN COUPLED RECEPTORS DM00013 G45774 18-309: P20-R307 G-protein coupled receptors motif: M112-I128	BLIMPS-PRINTS BLAST-PRODOR BLAST-DOMO MOTIFS
20	7476113CD1	313	S138 S189 S233 S292 S68 T205 T271 T301 T4	N136 N37 N7	Transmembrane domains: F29-V48; F102-D122 7 transmembrane receptor (rhodopsin family) domain: G42-Y291 G-protein coupled receptors signature BL00237: R91-P130; I283-K299 G-protein coupled receptors signature: F103-V147 Olfactory receptor signature PR00245: M60-K81; F178-D192; F239-G254; A275-L286; S292-L306 RECEPTOR OLFACTORY RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L167-L246 G-PROTEIN COUPLED RECEPTORS DM00013 S51356 18-307: P22-K299 G-protein coupled receptors motif: T111-I127	HMMER HMMER-PFAM BLIMPS-BLOCKS PROFILES SCAN BLIMPS-PRINTS BLAST-PRODOR BLAST-DOMO MOTIFS
21	7476117CD1	328	S139 S190 S293 S69 T206 T227 T272 T4 T8	N7	Transmembrane domains: L23-V42; F104-M120; P131-W153; L214-A233 7 transmembrane receptor (rhodopsin family) domain: G43-Y292 G-protein coupled receptors signature BL00237: R92-P131; I284-K300	HMMER HMMER-PFAM BLIMPS-BLOCKS

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
21					<p>Olfactory receptor signature PR00245: M61-M82; F179-D193; F240-G255; A276-L287; S293-I307</p> <p>RECEPTOR OLFACTORY RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L168-L247</p> <p>G-PROTEIN COUPLED RECEPTORS DM00013 S51356 18-307: E24-I303</p>	<p>BLIMPS- PRINTS</p> <p>BLAST- PRODOM</p> <p>BLAST-DOMO</p>
22	7476079CD1	324	S102 S13 S179 S7	N12	<p>Signal peptide: M1-A49</p> <p>Transmembrane domains: L40-I57; L75-W95; P142-V165; L211-I230; H253-T273</p> <p>7 transmembrane receptor (rhodopsin family) domain: A50-T146</p> <p>G-protein coupled receptors signature BL00237: K99-P138; P292-R308</p> <p>G-protein coupled receptors signature: Y111-L159</p> <p>Olfactory receptor signature PR00245: M68-K89; C186-D200; L247-T262</p> <p>Melanocortin receptor family signature PR00534: Q60-L72; I135-T146; T304-A317</p> <p>G-PROTEIN COUPLED RECEPTORS DM00013 G45774 18-309: P27-L315</p> <p>G-protein coupled receptors motif: M119-I135</p>	<p>SPSCAN</p> <p>HMMER</p> <p>HMMER-2FAM</p> <p>BLIMPS- BLOCKS</p> <p>PROFILES SCAN</p> <p>BLIMPS- PRINTS</p> <p>BLIMPS- PRINTS</p> <p>BLAST-DOMO</p> <p>MOTIFS</p>

Table 3 (cont.)

SEQ ID NO:	Incyte Polypeptide ID	Amino Acid Residues	Potential Phosphorylation Sites	Potential Glycosylation Sites	Signature Sequences, Domains and Motifs	Analytical Methods and Databases
23	7476112CD1	315	S137 S292 S51 S67 S8 T142 T88	N5	Transmembrane domains: M26-L44; L61-I78; A150-F168; L202-I229 7 transmembrane receptor (rhodopsin family) domain: G41-F291 G-protein coupled receptors signature BL00237: R90-P129; T283-K299 G-protein coupled receptors signature: F102-C147 Olfactory receptor signature PR00245: M59-R80; F177-D191; F239-G254; M275-L286; S292-C306 Melanocortin receptor family signature PR00534: S51-L63; I126-S137; V200-F212 RECEPTOR OLFACTORY PROTEIN RECEPTORLIKE GPROTEIN COUPLED TRANSMEMBRANE GLYCOPROTEIN MULTIGENE FAMILY PD000921: L166-L246 G-PROTEIN COUPLED RECEPTORS DM00013 P30954 29-316: S18-M302	HMER HMER-PFAM BLIMPS-BLOCKS PROFILES SCAN BLIMPS-PRINTS BLIMPS-PRINTS BLAST-PRODROM BLAST-DOMO

Table 4

Polynucleotide SEQ ID NO:	Incyte Polynucleotide ID	Sequence Length	Selected Fragments	Sequence Fragments	5' Position	3' Position
24	7475208CB1	2739	1276-1513, 1-1200, 1622-2183, 2299-2335, 2463-2739	7669623H1 (NOSEDIC02)	2123	2739
				GNN.g7523967_000013_002	1	2602
25	7475101CB1	993	252-993, 1-149	GNN.g7329615_000006_002	1	993
26	7475152CB1	990	1-27, 919-990, 777-819	GNN.g7329615_000004_002	1	990
27	7475164CB1	1125	470-1011, 1084-1125, 58-396	GNN.g3738097_004	1	1125
28	7475170CB1	939	1-30, 20-939	GNN.g6453999_000016_004	1	939
29	7475197CB1	978	1-872, 921-978	GNN.g7024166_000032_004	1	978
30	7475210CB1	936	1-112, 195-936	GNN.g7329615_000007_002	1	936
31	7475221CB1	1035	1-89, 1002-1035, 760-910	GNN.g7321527_000008_004	1	1035
32	7475244CB1	942	1-339, 396-942	GNN.g6806865_000020_002	1	942
33	7475293CB1	942	1-98, 190- 826, 904- 942	GNN.g7329615_000013_002	1	942
34	7475297CB1	930	1-354, 390-930	GNN.g6806865_000016_002	1	930
35	7475193CB1	942	1-230, 479-942	GNN.g7321521_000022_002	233	942
				GBI.g7321521_000022.rawcomp	1	360

Table 4 (cont.)

Polynucleotide SEQ ID NO:	Incyte Polynucleotide ID	Sequence Length	Selected Fragments	Sequence Fragments	5' Position	3' Position
36	7475213CB1	1029	1-297, 591-1029	GNN.g7134787_000015_002	1	1029
37	7475272CB1	933	1-835, 893-933	GNN.g7024166_000035_002	1	933
38	7475200CB1	948	1-381, 415-948	GNN.g7143464_000027_004	1	948
39	7475121CB1	951	386-951, 1-349	GNN.g6910525_000003_004	1	951
40	7475165CB1	1113	1-210, 418-717, 1068-1113	GNN.g4092817_004 g2525800	1 718	1113 934
41	7475273CB1	957	279-298, 416-635, 876-957	GNN.g6984471_000006_002	1	957
42	7476077CB1	966	1-333, 409-966	GNN.g7658497_000015_002	1	966
43	7476113CB1	975	439-852, 1-378, 930-975	GNN.g7705148_000007_002	1	975
44	7476117CB1	987	1-354, 885-987, 411-822	GNN.g7705148_000018_004	1	987
45	7476079CB1	975	1-190, 426-975	GNN.g7658497_000018_002	1	975
46	7476112CB1	948	574-948	GNN.g7690171_000001_002	1	948

Table 5

Polynucleotide SEQ ID NO:	Incyte Project ID	Representative Library
24	7475208CB1	NOSEDIC02

Table 6

Library	Vector	Library Description
NOSEDIC02	PSPORT1	This large size fractionated library was constructed using RNA isolated from nasal polyp tissue.

Table 7

Program	Description	Reference	Parameter Threshold
ABI FACTURA	A program that removes vector sequences and masks ambiguous bases in nucleic acid sequences.	Applied Biosystems, Foster City, CA.	
ABI/PARACEL FDF	A Fast Data Finder useful in comparing and annotating amino acid or nucleic acid sequences.	Applied Biosystems, Foster City, CA; Paracel Inc., Pasadena, CA.	Mismatch <50%
ABI AutoAssembler	A program that assembles nucleic acid sequences.	Applied Biosystems, Foster City, CA.	
BLAST	A Basic Local Alignment Search Tool useful in sequence similarity search for amino acid and nucleic acid sequences. BLAST includes five functions: blastp, blastn, blastx, tblastn, and tblastx.	Altschul, S.F. et al. (1990) J. Mol. Biol. 215:403-410; Altschul, S.F. et al. (1997) Nucleic Acids Res. 25:3389-3402.	ESTs: Probability value= 1.0E-8 or less Full Length sequences: Probability value= 1.0E-10 or less
FASTA	A Pearson and Lipman algorithm that searches for similarity between a query sequence and a group of sequences of the same type. FASTA comprises at least five functions: fasta, tfasta, fastx, tfastx, and ssearch.	Pearson, W.R. and D.J. Lipman (1988) Proc. Natl. Acad. Sci. USA 85:2444-2448; Pearson, W.R. (1990) Methods Enzymol. 183:63-98; and Smith, T.F. and M.S. Waterman (1981) Adv. Appl. Math. 2:482-489.	ESTs: fasta E value=1.06E-6 Assembled ESTs: fasta Identity= 95% or greater and Match length=200 bases or greater; fastx E value=1.0E-8 or less Full Length sequences: fastx score=100 or greater
BLIMPS	A BLocks IMProved Searcher that matches a sequence against those in BLOCKS, PRINTS, DOMO, PRODOM, and PFAM databases to search for gene families, sequence homology, and structural fingerprint regions.	Henikoff, S. and J.G. Henikoff (1991) Nucleic Acids Res. 19:6565-6572; Henikoff, J.G. and S. Henikoff (1996) Methods Enzymol. 266:88-105; and Attwood, T.K. et al. (1997) J. Chem. Inf. Comput. Sci. 37:417-424.	Probability value= 1.0E-3 or less
HMMER	An algorithm for searching a query sequence against hidden Markov model (HMM)-based databases of protein family consensus sequences, such as PFAM.	Krogh, A. et al. (1994) J. Mol. Biol. 235:1501-1531; Sonnhammer, E.L.L. et al. (1988) Nucleic Acids Res. 26:320-322; Durbin, R. et al. (1998) Our World View, in a Nutshell, Cambridge Univ. Press, pp. 1-350.	PFAM hits: Probability value= 1.0E-3 or less Signal peptide hits: Score= 0 or greater

Table 7 (cont.)

Program	Description	Reference	Parameter Threshold
ProfileScan	An algorithm that searches for structural and sequence motifs in protein sequences that match sequence patterns defined in Prosite.	Gribskov, M. et al. (1988) CABIOS 4:61-66; Gribskov, M. et al. (1989) Methods Enzymol. 183:146-159; Bairoch, A. et al. (1997) Nucleic Acids Res. 25:217-221.	Normalized quality score \geq GCG-specified "HIGH" value for that particular Prosite motif. Generally, score=1.4-2.1.
Phred	A base-calling algorithm that examines automated sequencer traces with high sensitivity and probability.	Ewing, B. et al. (1998) Genome Res. 8:175-185; Ewing, B. and P. Green (1998) Genome Res. 8:186-194.	
Phrap	A Phils Revised Assembly Program including SWAT and CrossMatch, programs based on efficient implementation of the Smith-Waterman algorithm, useful in searching sequence homology and assembling DNA sequences.	Smith, T.F. and M.S. Waterman (1981) Adv. Appl. Math. 2:482-489; Smith, T.F. and M.S. Waterman (1981) J. Mol. Biol. 147:195-197; and Green, P., University of Washington, Seattle, WA.	Score= 120 or greater; Match length= 56 or greater
Consed	A graphical tool for viewing and editing Phrap assemblies.	Gordon, D. et al. (1998) Genome Res. 8:195-202.	
SPScan	A weight matrix analysis program that scans protein sequences for the presence of secretory signal peptides.	Nielson, H. et al. (1997) Protein Engineering 10:1-6; Claverie, J.M. and S. Audic (1997) CABIOS 12:431-439.	Score=3.5 or greater
TMAP	A program that uses weight matrices to delineate transmembrane segments on protein sequences and determine orientation.	Persson, B. and P. Argos (1994) J. Mol. Biol. 237:182-192; Persson, B. and P. Argos (1996) Protein Sci. 5:363-371.	
TMHMMER	A program that uses a hidden Markov model (HMM) to delineate transmembrane segments on protein sequences and determine orientation.	Sonnhammer, E.L. et al. (1998) Proc. Sixth Intl. Conf. on Intelligent Systems for Mol. Biol., Glasgow et al., eds., The Am. Assoc. for Artificial Intelligence Press, Menlo Park, CA, pp. 175-182.	
Motifs	A program that searches amino acid sequences for patterns that matched those defined in Prosite.	Bairoch, A. et al. (1997) Nucleic Acids Res. 25:217-221; Wisconsin Package Program Manual, version 9, page M51-59, Genetics Computer Group, Madison, WI.	

Table 8

Tissues	Polynucleotide SEQ ID NO:												
	25	27	28	30	32	33	36	37	38	43	44	46	
Breast, Fat, Skin	+	+	+	+	-	+	+	+	+	+	-	+	
Muscle, Bone, Synovium, Connective tissue	+	+	+	+	-	-	-	+	+	+	-	-	
Pancreas, Liver, Gallbladder	+	+	+	+	-	-	+	-	+	+	-	-	
Brain: Amygdala, Thalamus, Hippocampus, Entorhinal cortex, Archaeocortex	+	+	+	+	+	-	-	-	+	+	-	-	
Brain: Striatum, Caudate nucleus, Putamen, Dentate nucleus, Globus pallidus, Substantia innominata, Ralphie magnus	+	-	-	-	-	-	-	-	+	+	-	-	
Kidney, Fetal colon, Small intestine, Ileum, Esophagus	+	+	+	-	-	-	-	+	+	+	-	-	
Fetal heart, Aorta, Coronary artery	-	-	-	-	-	-	+	-	+	+	-	-	
Fetal lung, Adult lung	+	-	+	-	+	-	+	+	+	+	+	-	
Placenta, Prostate, Uterus	-	-	+	+	-	-	+	+	+	+	-	-	
Olfactory bulb	+	-	+	-	-	-	+	-	+	+	-	-	

What is claimed is:

1. An isolated polypeptide selected from the group consisting of:
 - a) a polypeptide comprising an amino acid sequence selected from the group consisting of
5 SEQ ID NO:1-23,
 - b) a naturally occurring polypeptide comprising an amino acid sequence at least 90% identical to an amino acid sequence selected from the group consisting of SEQ ID NO:1-23,
 - c) a biologically active fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, and
 - 10 d) an immunogenic fragment of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23.
2. An isolated polypeptide of claim 1 selected from the group consisting of SEQ ID NO:1-
15 23.
3. An isolated polynucleotide encoding a polypeptide of claim 1.
4. An isolated polynucleotide encoding a polypeptide of claim 2.
- 20 5. An isolated polynucleotide of claim 4 selected from the group consisting of SEQ ID NO:24-46.
6. A recombinant polynucleotide comprising a promoter sequence operably linked to a polynucleotide of claim 3.
- 25 7. A cell transformed with a recombinant polynucleotide of claim 6.
8. A transgenic organism comprising a recombinant polynucleotide of claim 6.
- 30 9. A method for producing a polypeptide of claim 1, the method comprising:
 - a) culturing a cell under conditions suitable for expression of the polypeptide, wherein said cell is transformed with a recombinant polynucleotide, and said recombinant polynucleotide comprises a promoter sequence operably linked to a polynucleotide encoding the polypeptide of claim 1, and
 - 35 b) recovering the polypeptide so expressed.

10. An isolated antibody which specifically binds to a polypeptide of claim 1.

11. An isolated polynucleotide selected from the group consisting of:

- 5 of SEQ ID NO:24-46,
- a) a polynucleotide comprising a polynucleotide sequence selected from the group consisting
 - b) a naturally occurring polynucleotide comprising a polynucleotide sequence at least 90% identical to a polynucleotide sequence selected from the group consisting of SEQ ID NO:24-46,
 - c) a polynucleotide complementary to a polynucleotide of a),
 - d) a polynucleotide complementary to a polynucleotide of b), and
 - 10 e) an RNA equivalent of a)-d).

12. An isolated polynucleotide comprising at least 60 contiguous nucleotides of a polynucleotide of claim 11.

15 13. A method for detecting a target polynucleotide in a sample, said target polynucleotide having a sequence of a polynucleotide of claim 11, the method comprising:

- a) hybridizing the sample with a probe comprising at least 20 contiguous nucleotides comprising a sequence complementary to said target polynucleotide in the sample, and which probe specifically hybridizes to said target polynucleotide, under conditions whereby a hybridization
- 20 complex is formed between said probe and said target polynucleotide or fragments thereof, and
- b) detecting the presence or absence of said hybridization complex, and, optionally, if present, the amount thereof.

25 14. A method of claim 13, wherein the probe comprises at least 60 contiguous nucleotides.

15. A method for detecting a target polynucleotide in a sample, said target polynucleotide having a sequence of a polynucleotide of claim 11, the method comprising:

- a) amplifying said target polynucleotide or fragment thereof using polymerase chain reaction amplification, and
- 30 b) detecting the presence or absence of said amplified target polynucleotide or fragment thereof, and, optionally, if present, the amount thereof.

16. A composition comprising a polypeptide of claim 1 and a pharmaceutically acceptable excipient.

35

17. A composition of claim 16, wherein the polypeptide has an amino acid sequence selected from the group consisting of SEQ ID NO:1-23.

18. A method for treating a disease or condition associated with decreased expression of functional GCREC, comprising administering to a patient in need of such treatment the composition of claim 16.

19. A method for screening a compound for effectiveness as an agonist of a polypeptide of claim 1, the method comprising:

- a) exposing a sample comprising a polypeptide of claim 1 to a compound, and
- b) detecting agonist activity in the sample.

20. A composition comprising an agonist compound identified by a method of claim 19 and a pharmaceutically acceptable excipient.

21. A method for treating a disease or condition associated with decreased expression of functional GCREC, comprising administering to a patient in need of such treatment a composition of claim 20.

22. A method for screening a compound for effectiveness as an antagonist of a polypeptide of claim 1, the method comprising:

- a) exposing a sample comprising a polypeptide of claim 1 to a compound, and
- b) detecting antagonist activity in the sample.

23. A composition comprising an antagonist compound identified by a method of claim 22 and a pharmaceutically acceptable excipient.

24. A method for treating a disease or condition associated with overexpression of functional GCREC, comprising administering to a patient in need of such treatment a composition of claim 23.

25. A method of screening for a compound that specifically binds to the polypeptide of claim 1, said method comprising the steps of:

a) combining the polypeptide of claim 1 with at least one test compound under suitable conditions, and

b) detecting binding of the polypeptide of claim 1 to the test compound, thereby identifying a

compound that specifically binds to the polypeptide of claim 1.

26. A method of screening for a compound that modulates the activity of the polypeptide of claim 1, said method comprising:

- 5 a) combining the polypeptide of claim 1 with at least one test compound under conditions permissive for the activity of the polypeptide of claim 1,
- b) assessing the activity of the polypeptide of claim 1 in the presence of the test compound, and
- c) comparing the activity of the polypeptide of claim 1 in the presence of the test compound
- 10 with the activity of the polypeptide of claim 1 in the absence of the test compound, wherein a change in the activity of the polypeptide of claim 1 in the presence of the test compound is indicative of a compound that modulates the activity of the polypeptide of claim 1.

27. A method for screening a compound for effectiveness in altering expression of a target

15 polynucleotide, wherein said target polynucleotide comprises a sequence of claim 5, the method comprising:

- a) exposing a sample comprising the target polynucleotide to a compound, under conditions suitable for the expression of the target polynucleotide,
- b) detecting altered expression of the target polynucleotide, and
- 20 c) comparing the expression of the target polynucleotide in the presence of varying amounts of the compound and in the absence of the compound.

28. A method for assessing toxicity of a test compound, said method comprising:

- a) treating a biological sample containing nucleic acids with the test compound;
- 25 b) hybridizing the nucleic acids of the treated biological sample with a probe comprising at least 20 contiguous nucleotides of a polynucleotide of claim 11 under conditions whereby a specific hybridization complex is formed between said probe and a target polynucleotide in the biological sample, said target polynucleotide comprising a polynucleotide sequence of a polynucleotide of claim 11 or fragment thereof;
- 30 c) quantifying the amount of hybridization complex; and
- d) comparing the amount of hybridization complex in the treated biological sample with the amount of hybridization complex in an untreated biological sample, wherein a difference in the amount of hybridization complex in the treated biological sample is indicative of toxicity of the test compound.

29. A diagnostic test for a condition or disease associated with the expression of GCREC in a biological sample comprising the steps of:

- a) combining the biological sample with an antibody of claim 10, under conditions suitable for the antibody to bind the polypeptide and form an antibody:polypeptide complex; and
- b) detecting the complex, wherein the presence of the complex correlates with the presence of the polypeptide in the biological sample.

30. The antibody of claim 10, wherein the antibody is:

- a) a chimeric antibody,
- b) a single chain antibody,
- c) a Fab fragment,
- d) a $F(ab')_2$ fragment, or
- e) a humanized antibody.

31. A composition comprising an antibody of claim 10 and an acceptable excipient.

32. A method of diagnosing a condition or disease associated with the expression of GCREC in a subject, comprising administering to said subject an effective amount of the composition of claim

31.

33. A composition of claim 31, wherein the antibody is labeled.

34. A method of diagnosing a condition or disease associated with the expression of GCREC in a subject, comprising administering to said subject an effective amount of the composition of claim 33.

35. A method of preparing a polyclonal antibody with the specificity of the antibody of claim 10 comprising:

- a) immunizing an animal with a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, or an immunogenic fragment thereof, under conditions to elicit an antibody response;
- b) isolating antibodies from said animal; and
- c) screening the isolated antibodies with the polypeptide, thereby identifying a polyclonal

antibody which binds specifically to a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23.

36. An antibody produced by a method of claim 35.

37. A composition comprising the antibody of claim 36 and a suitable carrier.

38. A method of making a monoclonal antibody with the specificity of the antibody of claim 10 comprising:

a) immunizing an animal with a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23, or an immunogenic fragment thereof, under conditions to elicit an antibody response;

b) isolating antibody producing cells from the animal;

c) fusing the antibody producing cells with immortalized cells to form monoclonal antibody-producing hybridoma cells;

d) culturing the hybridoma cells; and

e) isolating from the culture monoclonal antibody which binds specifically to a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23.

39. A monoclonal antibody produced by a method of claim 38.

40. A composition comprising the antibody of claim 39 and a suitable carrier.

41. The antibody of claim 10, wherein the antibody is produced by screening a Fab expression library.

42. The antibody of claim 10, wherein the antibody is produced by screening a recombinant immunoglobulin library.

43. A method for detecting a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23 in a sample, comprising the steps of:

a) incubating the antibody of claim 10 with a sample under conditions to allow specific binding of the antibody and the polypeptide; and

b) detecting specific binding, wherein specific binding indicates the presence of a

polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23 in the sample.

44. A method of purifying a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23 from a sample, the method comprising:
- a) incubating the antibody of claim 10 with a sample under conditions to allow specific binding of the antibody and the polypeptide; and
 - b) separating the antibody from the sample and obtaining the purified polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-23.

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45. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:1.

46. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:2.

15

47. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:3.

48. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:4.

49. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:5.

20

50. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:6.

51. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:7.

25

52. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:8.

53. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:9.

54. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:10.

30

55. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:11.

56. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:12.

57. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:13.

58. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:14.

5 59. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:15.

60. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:16.

61. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:17.

10

62. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:18.

63. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:19.

15

64. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:20.

65. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:21.

66. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:22.

20

67. A polypeptide of claim 1, comprising the amino acid sequence of SEQ ID NO:23.

68. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:24.

25

69. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:25.

30

70. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:26.

71. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:27.

72. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:28.

73. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
5 NO:29.

74. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:30.

10 75. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:31.

76. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
15 NO:32.

77. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:33.

20 78. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:34.

79. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:35.

25 80. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:36.

81. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
30 NO:37.

82. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:38.

83. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:39.

84. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
5 NO:40.

85. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:41.

10
86. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:42.

87. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
15 NO:43.

88. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:44.

20
89. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
NO:45.

90. A polynucleotide of claim 11, comprising the polynucleotide sequence of SEQ ID
25 NO:46.

<110> INCYTE GENOMICS, INC.
 PATTERSON, Chandra
 TRIBOULEY, Catherine M.
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 THORNTON, Michael
 LU, Yan
 KALLICK, Deborah A.
 GANDHI, Ameena R.
 AU-YOUNG, Janice

<120> G-PROTEIN COUPLED RECEPTORS

<130> SF-0781 PCT

<140> To Be Assigned

<141> Herewith

<150> 60/206,222; 60/207,476; 60/208,834; 60/208,861; 60/209,868

<151> 2000-05-22; 2000-05-25; 2000-06-02; 2000-06-02; 2000-06-07

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<211> 855

<212> PRT

<213> Homo sapiens

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				20					25					30
Met	Lys	Gly	Asp	Tyr	Val	Leu	Gly	Gly	Leu	Phe	Pro	Leu	Gly	Glu
				35					40					45
Ala	Glu	Glu	Ala	Gly	Leu	Arg	Ser	Arg	Thr	Arg	Pro	Ser	Ser	Pro
				50					55					60
Val	Cys	Thr	Arg	Phe	Ser	Ser	Asn	Gly	Leu	Leu	Trp	Ala	Leu	Ala
				65					70					75
Met	Lys	Met	Ala	Val	Glu	Glu	Ile	Asn	Asn	Lys	Ser	Asp	Leu	Leu
				80					85					90
Pro	Gly	Leu	Arg	Leu	Gly	Tyr	Asp	Leu	Phe	Asp	Thr	Cys	Ser	Glu
				95					100					105
Pro	Val	Val	Ala	Met	Lys	Pro	Ser	Leu	Met	Phe	Leu	Ala	Lys	Ala
				110					115					120
Gly	Ser	Arg	Asp	Ile	Ala	Ala	Tyr	Cys	Asn	Tyr	Thr	Gln	Tyr	Gln
				125					130					135
Pro	Arg	Val	Leu	Ala	Val	Ile	Gly	Pro	His	Ser	Ser	Glu	Leu	Ala
				140					145					150
Met	Val	Thr	Gly	Lys	Phe	Phe	Ser	Phe	Phe	Leu	Met	Pro	Gln	Val
				155					160					165
Ala	Pro	Pro	Thr	Ile	Thr	His	Pro	His	Pro	Ala	Leu	Pro	Val	Gly
				170					175					180
Ala	Pro	Val	Ser	Gly	Asp	Ala	Ser	Trp	Pro	Leu	Gln	Val	Ser	Tyr
				185					190					195
Gly	Ala	Ser	Met	Glu	Leu	Leu	Ser	Ala	Arg	Glu	Thr	Phe	Pro	Ser
				200					205					210

Phe	Phe	Arg	Thr	Val	Pro	Ser	Asp	Arg	Val	Gln	Leu	Thr	Ala	Ala
				215					220					225
Ala	Glu	Leu	Leu	Gln	Glu	Phe	Gly	Trp	Asn	Trp	Val	Ala	Ala	Leu
				230					235					240
Gly	Ser	Asp	Asp	Glu	Tyr	Gly	Arg	Gln	Gly	Leu	Ser	Ile	Phe	Ser
				245					250					255
Ala	Leu	Ala	Arg	His	Ala	Ala	Ser	Ala	Ser	Arg	Thr	Arg	Ala	Trp
				260					265					270
Cys	Arg	Cys	Pro	Val	Gln	Asp	Val	Leu	His	Gln	Val	Asn	Gln	Ser
				275					280					285
Ser	Val	Gln	Val	Val	Leu	Leu	Phe	Ala	Ser	Val	His	Ala	Ala	His
				290					295					300
Ala	Leu	Phe	Asn	Tyr	Ser	Ile	Ser	Ser	Arg	Leu	Ser	Pro	Lys	Val
				305					310					315
Trp	Val	Ala	Ser	Glu	Ala	Trp	Leu	Thr	Ser	Asp	Leu	Val	Met	Gly
				320					325					330
Leu	Pro	Gly	Met	Ala	Gln	Met	Gly	Thr	Val	Leu	Gly	Phe	Leu	Gln
				335					340					345
Arg	Gly	Ala	Gln	Leu	His	Glu	Phe	Pro	Gln	Tyr	Val	Lys	Thr	His
				350					355					360
Leu	Ala	Leu	Ala	Thr	Asp	Pro	Ala	Phe	Cys	Ser	Ala	Leu	Gly	Glu
				365					370					375
Arg	Glu	Gln	Gly	Leu	Glu	Glu	Asp	Val	Val	Gly	Gln	Arg	Cys	Pro
				380					385					390
Gln	Cys	Asp	Cys	Ile	Thr	Leu	Gln	Asn	Arg	Ala	Gln	Ala	Leu	His
				395					400					405
Asn	Thr	Leu	Gln	Cys	Asn	Ala	Ser	Gly	Cys	Pro	Ala	Gln	Asp	Pro
				410					415					420
Val	Lys	Pro	Trp	Gln	Leu	Leu	Glu	Asn	Met	Tyr	Asn	Leu	Thr	Phe
				425					430					435
His	Val	Gly	Gly	Leu	Pro	Leu	Arg	Phe	Asp	Ser	Ser	Gly	Asn	Val
				440					445					450
Asp	Met	Glu	Tyr	Asp	Leu	Lys	Leu	Trp	Val	Trp	Gln	Gly	Ser	Val
				455					460					465
Pro	Arg	Leu	His	Asp	Val	Gly	Arg	Phe	Asn	Gly	Ser	Leu	Arg	Thr
				470					475					480
Glu	Arg	Leu	Lys	Ile	Arg	Trp	His	Thr	Ser	Asp	Asn	Gln	Pro	Ser
				485					490					495
Arg	Ala	Arg	Pro	Gln	Ala	Cys	Ala	Gln	Lys	Pro	Val	Ser	Arg	Cys
				500					505					510
Ser	Arg	Gln	Cys	Gln	Glu	Gly	Gln	Val	Arg	Arg	Val	Lys	Gly	Phe
				515					520					525
His	Ser	Cys	Cys	Tyr	Asp	Cys	Val	Asp	Cys	Glu	Ala	Gly	Ser	Tyr
				530					535					540
Arg	Gln	Asn	Pro	Asp	Asp	Ile	Ala	Cys	Thr	Phe	Cys	Gly	Gln	Asp
				545					550					555
Glu	Trp	Ser	Pro	Glu	Arg	Ser	Thr	Arg	Cys	Phe	Arg	Arg	Arg	Ser
				560					565					570
Arg	Phe	Leu	Ala	Trp	Gly	Glu	Pro	Ala	Val	Leu	Leu	Leu	Leu	Leu
				575					580					585
Leu	Leu	Ser	Leu	Ala	Leu	Gly	Leu	Val	Leu	Ala	Ala	Leu	Gly	Leu
				590					595					600
Phe	Val	His	His	Arg	Asp	Ser	Pro	Leu	Val	Gln	Ala	Ser	Gly	Gly
				605					610					615
Pro	Leu	Ala	Cys	Phe	Gly	Leu	Val	Cys	Leu	Gly	Leu	Val	Cys	Leu
				620					625					630
Ser	Val	Leu	Leu	Phe	Pro	Gly	Gln	Pro	Ser	Pro	Ala	Arg	Cys	Leu
				635					640					645
Ala	Gln	Gln	Pro	Leu	Ser	His	Leu	Pro	Leu	Thr	Gly	Cys	Leu	Ser
				650					655					660
Thr	Leu	Phe	Leu	Gln	Ala	Ala	Glu	Ile	Phe	Val	Glu	Ser	Glu	Leu
				665					670					675
Pro	Leu	Ser	Trp	Ala	Asp	Arg	Leu	Ser	Gly	Cys	Leu	Arg	Gly	Pro

680	685	690
Trp Ala Trp Leu Val Val Leu Leu Ala Met Leu Val Glu Val Ala		
695	700	705
Leu Cys Thr Trp Tyr Leu Val Ala Phe Pro Pro Glu Val Val Thr		
710	715	720
Gly Leu Ala His Ala Ala His Gly Gly Ala Gly Ala Leu Pro His		
725	730	735
Thr Leu Leu Gly Gln Leu Arg Pro Ser Ala Arg His His Ala Thr		
740	745	750
Leu Ala Phe Leu Cys Phe Thr Gly His Phe Pro Gly Ala Glu Pro		
755	760	765
Ala Gly Pro Leu Gln Pro Cys His Val Ala Ser His Ile Cys His		
770	775	780
Ala Gly Leu Leu His His Thr Gly Ser His Phe Val Pro Leu Leu		
785	790	795
Ala Gln Cys Ala Gly Gly His Ser Gly Pro Ala Val Gln Met Gly		
800	805	810
Ala Leu Leu Leu Cys Val Leu Gly Ile Leu Ala Ala Phe His Leu		
815	820	825
Pro Arg Cys Tyr Leu Leu Met Arg Gln Pro Gly Leu Asn Thr Pro		
830	835	840
Glu Phe Phe Leu Gly Gly Gly Pro Gly Asp Ala Thr Arg Pro Glu		
845	850	855

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Gly Ile Phe Leu Gly Met Tyr Leu Val Thr Met Val Gly Asn Leu		
	50	55
Leu Ile Ile Leu Ala Ile Ser Ser Asp Pro His Leu His Thr Pro		
	65	70
Met Tyr Phe Phe Leu Ala Asn Leu Ser Leu Thr Asp Ala Cys Phe		
	80	85
Thr Ser Ala Ser Ile Pro Lys Met Leu Ala Asn Ile His Thr Gln		
	95	100
Ser Gln Ile Ile Ser Tyr Ser Gly Cys Leu Ala Gln Leu Tyr Phe		
	110	115
Leu Leu Met Phe Gly Gly Leu Asp Asn Cys Leu Leu Ala Val Met		
	125	130
Ala Tyr Asp Arg Tyr Val Ala Ile Cys Gln Pro Leu His Tyr Ser		
	140	145
Thr Ser Met Ser Pro Gln Leu Cys Ala Leu Met Leu Gly Val Cys		
	155	160
Trp Val Leu Thr Asn Cys Pro Ala Leu Met His Thr Leu Leu Leu		
	170	175
Thr Arg Val Ala Phe Cys Ala Gln Lys Ala Ile Pro His Phe Tyr		
	185	190
Cys Asp Pro Ser Ala Leu Leu Lys Leu Ala Cys Ser Asp Thr His		
	200	205

Val	Asn	Glu	Leu	Met	Ile	Ile	Thr	Met	Gly	Leu	Leu	Phe	Leu	Thr
				215					220					225
Val	Pro	Leu	Leu	Leu	Ile	Val	Phe	Ser	Tyr	Val	Arg	Ile	Phe	Trp
				230					235					240
Ala	Val	Phe	Val	Ile	Ser	Ser	Pro	Gly	Gly	Arg	Trp	Lys	Ala	Phe
				245					250					255
Ser	Thr	Cys	Gly	Ser	His	Leu	Thr	Val	Val	Leu	Leu	Phe	Tyr	Gly
				260					265					270
Ser	Leu	Met	Gly	Val	Tyr	Leu	Leu	Pro	Pro	Ser	Thr	Tyr	Ser	Thr
				275					280					285
Glu	Arg	Glu	Ser	Arg	Ala	Ala	Val	Leu	Tyr	Met	Val	Ile	Ile	Pro
				290					295					300
Thr	Leu	Asn	Pro	Phe	Ile	Tyr	Ser	Leu	Arg	Asn	Arg	Asp	Met	Lys
				305					310					315
Glu	Ala	Leu	Gly	Lys	Leu	Phe	Val	Ser	Gly	Lys	Thr	Phe	Phe	Leu
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Gly	Leu	Ser	Ser	Arg	Ser	Glu	Asp	Gln	Arg	Pro	Leu	Phe	Ala	Leu
				20					25					30
Phe	Leu	Ile	Ile	Tyr	Leu	Val	Thr	Leu	Met	Gly	Asn	Leu	Leu	Ile
				35					40					45
Ile	Leu	Ala	Ile	His	Ser	Asp	Pro	Arg	Leu	Gln	Asn	Pro	Met	Tyr
				50					55					60
Phe	Phe	Leu	Ser	Ile	Leu	Ser	Phe	Ala	Asp	Ile	Cys	Tyr	Thr	Thr
				65					70					75
Val	Ile	Val	Pro	Lys	Met	Leu	Val	Asn	Phe	Leu	Ser	Glu	Lys	Lys
				80					85					90
Thr	Ile	Ser	Tyr	Ala	Glu	Cys	Leu	Ala	Gln	Met	Tyr	Phe	Phe	Leu
				95					100					105
Val	Phe	Gly	Asn	Ile	Asp	Ser	Tyr	Leu	Leu	Ala	Ala	Met	Ala	Ile
				110					115					120
Asn	Arg	Cys	Val	Ala	Ile	Cys	Asn	Pro	Phe	His	Tyr	Val	Thr	Val
				125					130					135
Met	Asn	Arg	Arg	Cys	Cys	Val	Leu	Leu	Leu	Ala	Phe	Pro	Ile	Thr
				140					145					150
Phe	Ser	Tyr	Phe	His	Ser	Leu	Leu	His	Val	Leu	Leu	Val	Asn	Arg
				155					160					165
Leu	Thr	Phe	Cys	Thr	Ser	Asn	Val	Ile	His	His	Phe	Phe	Cys	Asp
				170					175					180
Val	Asn	Pro	Val	Leu	Lys	Leu	Ser	Cys	Ser	Ser	Thr	Phe	Val	Asn
				185					190					195
Glu	Ile	Val	Ala	Met	Thr	Glu	Gly	Leu	Ala	Ser	Val	Met	Ala	Pro
				200					205					210
Phe	Val	Cys	Ile	Ile	Ile	Ser	Tyr	Leu	Arg	Ile	Leu	Ile	Ala	Val
				215					220					225
Leu	Lys	Ile	Pro	Ser	Ala	Ala	Gly	Lys	His	Lys	Ala	Phe	Ser	Thr
				230					235					240
Cys	Ser	Ser	His	Leu	Thr	Val	Val	Ile	Leu	Phe	Tyr	Gly	Ser	Ile
				245					250					255
Ser	Tyr	Val	Tyr	Leu	Gln	Pro	Leu	Ser	Ser	Tyr	Thr	Val	Lys	Asp

Arg	Ile	Ala	Thr	260	Ile	Asn	Tyr	Thr	Val	265	Leu	Thr	Ser	Val	Leu	Asn	270
				275						280							285
Pro	Phe	Ile	Tyr		Ser	Leu	Arg	Asn	Lys		Asp	Met	Lys	Arg	Gly	Leu	
				290						295							300
Gln	Lys	Leu	Ile		Asn	Lys	Ile	Lys	Ser		Gln	Met	Ser	Arg	Phe	Ser	
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Thr	Lys	Thr	Asn		Lys	Ile	Cys	Gly	Pro								
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<223> Incyte ID No: 7475164CD1

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				20					25					30			
Ser	Gly	Ala	Met	Ala	His	Thr	Arg	Cys	Met	Leu	Lys	Leu	Thr	Ser			
				35					40					45			
Cys	Glu	Ala	Asn	Thr	Ile	Asn	His	Tyr	Phe	Cys	Asp	Thr	Leu	His			
				50					55					60			
Leu	Leu	Gln	Leu	Ser	Cys	Thr	Ser	Thr	Tyr	Val	Arg	Ala	Glu	Phe			
				65					70					75			
Ile	Leu	Ala	Gly	Leu	Thr	Gln	Arg	Pro	Glu	Leu	Gln	Leu	Pro	Leu			
				80					85					90			
Phe	Leu	Leu	Phe	Leu	Gly	Ile	Tyr	Val	Val	Thr	Val	Val	Gly	Asn			
				95					100					105			
Leu	Gly	Met	Ile	Phe	Leu	Ile	Ala	Leu	Ser	Ser	Gln	Leu	Tyr	Pro			
				110					115					120			
Pro	Val	Tyr	Tyr	Phe	Leu	Ser	His	Leu	Ser	Phe	Ile	Asp	Leu	Cys			
				125					130					135			
Tyr	Ser	Ser	Val	Ile	Thr	Pro	Lys	Met	Leu	Val	Asn	Phe	Val	Pro			
				140					145					150			
Glu	Glu	Asn	Ile	Ile	Ser	Phe	Leu	Glu	Cys	Ile	Thr	Gln	Leu	Tyr			
				155					160					165			
Phe	Phe	Leu	Ile	Phe	Val	Ile	Ala	Glu	Gly	Tyr	Leu	Leu	Thr	Ala			
				170					175					180			
Met	Glu	Tyr	Asp	Arg	Tyr	Val	Ala	Ile	Cys	Arg	Pro	Leu	Leu	Tyr			
				185					190					195			
Asn	Ile	Val	Met	Ser	His	Arg	Val	Cys	Ser	Ile	Met	Met	Ala	Val			
				200					205					210			
Val	Tyr	Ser	Leu	Gly	Phe	Leu	Trp	Ala	Thr	Val	His	Thr	Thr	Arg			
				215					220					225			
Met	Ser	Val	Leu	Ser	Phe	Cys	Arg	Ser	His	Thr	Val	Ser	His	Tyr			
				230					235					240			
Phe	Cys	Asp	Ile	Leu	Pro	Leu	Leu	Thr	Leu	Ser	Cys	Ser	Ser	Thr			
				245					250					255			
His	Ile	Asn	Glu	Ile	Leu	Leu	Phe	Ile	Ile	Gly	Gly	Val	Asn	Thr			
				260					265					270			
Leu	Ala	Thr	Thr	Leu	Ala	Val	Leu	Ile	Ser	Tyr	Ala	Phe	Ile	Phe			
				275					280					285			
Ser	Ser	Ile	Leu	Gly	Ile	His	Ser	Thr	Glu	Gly	Gln	Ser	Lys	Ala			
				290					295					300			
Phe	Gly	Thr	Cys	Ser	Ser	His	Leu	Leu	Ala	Val	Gly	Ile	Phe	Phe			
				305					310					315			
Gly	Ser	Ile	Thr	Phe	Met	Tyr	Phe	Lys	Pro	Pro	Ser	Ser	Thr	Thr			

Met Glu Lys Glu Lys Val Ser Ser Val	320	Phe Tyr Ile Thr Ile Ile	325	330
Pro Met Leu Asn Pro Leu Ile Tyr Ser	335	Leu Arg Asn Lys Asp Val	340	345
Lys Asn Ala Leu Lys Lys Met Thr Arg	350	Gly Arg Gln Ser Ser	355	360
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Leu Leu Ile Phe Tyr Ile Phe Thr Leu Leu Gly Asn Lys Thr Ile	35	40	45	
Ile Val Leu Ser His Leu Asp Pro His Leu His Thr Pro Met Tyr	50	55	60	
Phe Phe Phe Ser Asn Leu Ser Phe Leu Asp Leu Cys Tyr Thr Thr	65	70	75	
Gly Ile Val Pro Gln Leu Leu Val Asn Leu Arg Gly Ala Asp Lys	80	85	90	
Ser Ile Ser Tyr Gly Gly Cys Val Val Gln Leu Tyr Ile Ser Leu	95	100	105	
Gly Leu Gly Ser Thr Glu Cys Val Leu Leu Gly Val Met Val Phe	110	115	120	
Asp Arg Tyr Ala Ala Val Cys Arg Pro Leu His Tyr Thr Val Val	125	130	135	
Met His Pro Cys Leu Tyr Val Leu Met Ala Ser Thr Ser Trp Val	140	145	150	
Ile Gly Phe Ala Asn Ser Leu Leu Gln Thr Val Leu Ile Leu Leu	155	160	165	
Leu Thr Leu Cys Gly Arg Asn Lys Leu Glu His Phe Leu Cys Glu	170	175	180	
Val Pro Pro Leu Leu Lys Leu Ala Cys Val Asp Thr Thr Met Asn	185	190	195	
Glu Ser Glu Leu Phe Phe Val Ser Val Ile Ile Leu Leu Val Pro	200	205	210	
Val Ala Leu Ile Ile Phe Ser Tyr Ser Gln Ile Val Arg Ala Val	215	220	225	
Met Arg Ile Lys Leu Ala Thr Gly Gln Arg Lys Val Phe Gly Thr	230	235	240	
Cys Gly Ser His Leu Thr Val Val Ser Leu Phe Tyr Gly Thr Ala	245	250	255	
Ile Tyr Ala Tyr Leu Gln Pro Gly Asn Asn Tyr Ser Gln Asp Gln	260	265	270	
Gly Lys Phe Ile Ser Leu Phe Tyr Thr Ile Ile Thr Pro Met Ile	275	280	285	
Asn Pro Leu Ile Tyr Thr Leu Arg Asn Lys Asp Val Lys Gly Ala	290	295	300	
Leu Lys Lys Val Leu Trp Lys Asn Tyr Asp Ser Arg	305	310		

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 Phe Lys Gln Asp Glu His Gln Asn Leu Leu Phe Val Leu Phe Leu
 35 40 45
 Gly Met Tyr Leu Val Thr Val Ile Gly Asn Gly Leu Ile Ile Val
 50 55 60
 Ala Ile Ser Leu Asp Thr Tyr Leu His Thr Pro Met Tyr Leu Phe
 65 70 75
 Leu Ala Asn Leu Ser Phe Ala Asp Ile Ser Ser Ile Ser Asn Ser
 80 85 90
 Val Pro Lys Met Leu Val Asn Ile Gln Thr Lys Ser Gln Ser Ile
 95 100 105
 Ser Tyr Glu Ser Cys Ile Thr Gln Met Tyr Phe Ser Ile Val Phe
 110 115 120
 Val Val Ile Asp Asn Leu Leu Leu Gly Thr Met Ala Tyr Asp His
 125 130 135
 Phe Val Ala Ile Cys His Pro Leu Asn Tyr Thr Ile Leu Met Arg
 140 145 150
 Pro Arg Phe Gly Ile Leu Leu Thr Val Ile Ser Trp Phe Leu Ser
 155 160 165
 Asn Ile Ile Ala Leu Thr His Thr Leu Leu Leu Ile Gln Leu Leu
 170 175 180
 Phe Cys Asn His Asn Thr Leu Pro His Phe Phe Cys Asp Leu Ala
 185 190 195
 Pro Leu Leu Lys Leu Ser Cys Ser Asp Thr Leu Ile Asn Glu Leu
 200 205 210
 Val Leu Phe Ile Val Gly Leu Ser Val Ile Ile Phe Pro Phe Thr
 215 220 225
 Leu Ser Phe Phe Ser Tyr Val Cys Ile Ile Arg Ala Val Leu Arg
 230 235 240
 Val Ser Ser Thr Gln Gly Lys Trp Lys Ala Phe Ser Thr Cys Gly
 245 250 255
 Ser His Leu Thr Val Val Leu Leu Phe Tyr Gly Thr Ile Val Gly
 260 265 270
 Val Tyr Phe Phe Pro Ser Ser Thr His Pro Glu Asp Thr Asp Lys
 275 280 285
 Ile Gly Ala Val Leu Phe Thr Val Val Thr Pro Met Ile Asn Pro
 290 295 300
 Phe Ile Tyr Ser Leu Arg Asn Lys Asp Met Lys Gly Ala Leu Arg
 305 310 315
 Lys Leu Ile Asn Arg Lys Ile Ser Ser Leu
 320 325

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 <211> 311
 <212> PRT
 <213> Homo sapiens

<220>
 <221> misc_feature
 <223> Incyte ID No: 7475210CD1

<400> 7

Met	Glu	Asn	Gln	Ser	Ser	Ile	Ser	Glu	Phe	Phe	Leu	Arg	Gly	Ile	
1				5					10					15	
Ser	Ala	Pro	Pro	Glu	Gln	Gln	Gln	Ser	Leu	Phe	Gly	Ile	Phe	Leu	
				20					25					30	
Cys	Met	Tyr	Leu	Val	Thr	Leu	Thr	Gly	Asn	Leu	Leu	Ile	Ile	Leu	
				35					40					45	
Ala	Ile	Gly	Ser	Asp	Leu	His	Leu	His	Thr	Pro	Met	Tyr	Phe	Phe	
				50					55					60	
Leu	Ala	Asn	Leu	Ser	Phe	Val	Asp	Met	Gly	Leu	Thr	Ser	Ser	Thr	
				65					70					75	
Val	Thr	Lys	Met	Leu	Val	Asn	Ile	Gln	Thr	Arg	His	His	Thr	Ile	
				80					85					90	
Ser	Tyr	Thr	Gly	Cys	Leu	Thr	Gln	Met	Tyr	Phe	Phe	Leu	Met	Phe	
				95					100					105	
Gly	Asp	Leu	Asp	Ser	Phe	Phe	Leu	Ala	Ala	Met	Ala	Tyr	Asp	Arg	
				110					115					120	
Tyr	Val	Ala	Ile	Cys	His	Pro	Leu	Cys	Tyr	Ser	Thr	Val	Met	Arg	
				125					130					135	
Pro	Gln	Val	Cys	Ala	Leu	Met	Leu	Ala	Leu	Cys	Trp	Val	Leu	Thr	
				140					145					150	
Asn	Ile	Val	Ala	Leu	Thr	His	Thr	Phe	Leu	Met	Ala	Arg	Leu	Ser	
				155					160					165	
Phe	Cys	Val	Thr	Gly	Glu	Ile	Ala	His	Phe	Phe	Cys	Asp	Ile	Thr	
				170					175					180	
Pro	Val	Leu	Lys	Leu	Ser	Cys	Ser	Asp	Thr	His	Ile	Asn	Glu	Met	
				185					190					195	
Met	Val	Phe	Val	Leu	Gly	Gly	Thr	Val	Leu	Ile	Val	Pro	Phe	Leu	
				200					205					210	
Cys	Ile	Val	Thr	Ser	Tyr	Ile	His	Ile	Val	Pro	Ala	Ile	Leu	Arg	
				215					220					225	
Val	Arg	Thr	Arg	Gly	Gly	Val	Gly	Lys	Ala	Phe	Ser	Thr	Cys	Ser	
				230					235					240	
Ser	His	Leu	Cys	Val	Val	Cys	Val	Phe	Tyr	Gly	Thr	Leu	Phe	Ser	
				245					250					255	
Ala	Tyr	Leu	Cys	Pro	Pro	Ser	Ile	Ala	Ser	Glu	Glu	Lys	Asp	Ile	
				260					265					270	
Ala	Ala	Ala	Ala	Met	Tyr	Thr	Ile	Val	Thr	Pro	Met	Leu	Asn	Pro	
				275					280					285	
Phe	Ile	Tyr	Ser	Leu	Arg	Asn	Lys	Asp	Met	Lys	Gly	Ala	Leu	Lys	
				290					295					300	
Arg	Leu	Phe	Ser	His	Arg	Ser	Ile	Val	Ser	Ser					
				305					310						

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<211> 344

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475221CD1

<400> 8

Met	Glu	Leu	Leu	Thr	Asn	Asn	Leu	Lys	Phe	Ile	Thr	Asp	Pro	Phe	
1				5					10					15	
Val	Cys	Arg	Leu	Arg	His	Leu	Ser	Pro	Thr	Pro	Ser	Glu	Glu	His	
				20					25					30	
Met	Lys	Asn	Lys	Asn	Asn	Val	Thr	Glu	Phe	Ile	Leu	Leu	Gly	Leu	
				35					40					45	
Thr	Gln	Asn	Pro	Glu	Gly	Gln	Lys	Val	Leu	Phe	Val	Thr	Phe	Leu	
				50					55					60	
Leu	Ile	Tyr	Met	Val	Thr	Ile	Met	Gly	Asn	Leu	Leu	Ile	Ile	Val	
				65					70					75	

Thr	Ile	Met	Ala	Ser	Gln	Ser	Leu	Gly	Ser	Pro	Met	Tyr	Phe	Phe	
				80					85					90	
Leu	Ala	Ser	Leu	Ser	Phe	Ile	Asp	Thr	Val	Tyr	Ser	Thr	Ala	Phe	
				95					100					105	
Ala	Pro	Lys	Met	Ile	Val	Asp	Leu	Leu	Ser	Glu	Lys	Lys	Thr	Ile	
				110					115					120	
Ser	Phe	Gln	Gly	Cys	Met	Ala	Gln	Leu	Phe	Met	Asp	His	Leu	Phe	
				125					130					135	
Ala	Gly	Ala	Glu	Val	Ile	Leu	Leu	Val	Val	Met	Ala	Tyr	Asp	Arg	
				140					145					150	
Tyr	Met	Ala	Ile	Cys	Lys	Pro	Leu	His	Glu	Leu	Ile	Thr	Met	Asn	
				155					160					165	
Arg	Arg	Val	Cys	Val	Leu	Met	Leu	Leu	Ala	Ala	Trp	Ile	Gly	Gly	
				170					175					180	
Phe	Leu	His	Ser	Leu	Val	Gln	Phe	Leu	Phe	Ile	Tyr	Gln	Leu	Pro	
				185					190					195	
Phe	Cys	Gly	Pro	Asn	Val	Ile	Asp	Asn	Phe	Leu	Cys	Asp	Leu	Tyr	
				200					205					210	
Pro	Leu	Leu	Lys	Leu	Ala	Cys	Thr	Asn	Thr	Tyr	Val	Thr	Gly	Leu	
				215					220					225	
Ser	Met	Ile	Ala	Asn	Gly	Gly	Ala	Ile	Cys	Ala	Val	Thr	Phe	Phe	
				230					235					240	
Thr	Ile	Leu	Leu	Ser	Tyr	Gly	Val	Ile	Leu	His	Ser	Leu	Lys	Thr	
				245					250					255	
Gln	Ser	Leu	Glu	Gly	Lys	Arg	Lys	Ala	Phe	Tyr	Thr	Cys	Ala	Ser	
				260					265					270	
His	Val	Thr	Val	Val	Ile	Leu	Phe	Phe	Val	Pro	Cys	Ile	Phe	Leu	
				275					280					285	
Tyr	Ala	Arg	Pro	Asn	Ser	Thr	Phe	Pro	Ile	Asp	Lys	Ser	Met	Thr	
				290					295					300	
Val	Val	Leu	Thr	Phe	Ile	Thr	Pro	Met	Leu	Asn	Pro	Leu	Ile	Tyr	
				305					310					315	
Thr	Leu	Lys	Asn	Ala	Glu	Met	Lys	Ser	Ala	Met	Arg	Lys	Leu	Trp	
				320					325					330	
Ser	Lys	Lys	Val	Ser	Leu	Ala	Gly	Lys	Trp	Leu	Tyr	His	Ser		
				335					340						

<210> 9

<211> 313

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475244CD1

<400> 9

Met	Ala	Ser	Glu	Arg	Asn	Gln	Ser	Ser	Thr	Pro	Thr	Phe	Ile	Leu	
1				5					10					15	
Leu	Gly	Phe	Ser	Glu	Tyr	Pro	Glu	Ile	Gln	Val	Pro	Leu	Phe	Leu	
				20					25					30	
Val	Phe	Leu	Phe	Val	Tyr	Thr	Val	Thr	Val	Val	Gly	Asn	Leu	Gly	
				35					40					45	
Met	Ile	Ile	Ile	Ile	Arg	Leu	Asn	Ser	Lys	Leu	His	Thr	Ile	Met	
				50					55					60	
Tyr	Phe	Phe	Leu	Ser	His	Leu	Ser	Leu	Thr	Asp	Phe	Cys	Phe	Ser	
				65					70					75	
Thr	Val	Val	Thr	Pro	Lys	Leu	Leu	Glu	Asn	Leu	Val	Val	Glu	Tyr	
				80					85					90	
Arg	Thr	Ile	Ser	Phe	Ser	Gly	Cys	Ile	Met	Gln	Phe	Cys	Phe	Ala	
				95					100					105	
Cys	Ile	Phe	Gly	Val	Thr	Glu	Thr	Phe	Met	Leu	Ala	Ala	Met	Ala	
				110					115					120	

Tyr	Asp	Arg	Phe	Val	Ala	Val	Cys	Lys	Pro	Leu	Leu	Tyr	Thr	Thr		
				125					130						135	
Ile	Met	Ser	Gln	Lys	Leu	Cys	Ala	Leu	Leu	Val	Ala	Gly	Ser	Tyr		
				140					145						150	
Thr	Trp	Gly	Ile	Val	Cys	Ser	Leu	Ile	Leu	Thr	Tyr	Phe	Leu	Leu		
				155					160						165	
Asp	Leu	Ser	Phe	Cys	Glu	Ser	Thr	Phe	Ile	Asn	Asn	Phe	Ile	Cys		
				170					175						180	
Asp	His	Ser	Val	Ile	Val	Ser	Ala	Ser	Tyr	Ser	Asp	Pro	Tyr	Ile		
				185					190						195	
Ser	Gln	Arg	Leu	Cys	Phe	Ile	Ile	Ala	Ile	Phe	Asn	Glu	Val	Ser		
				200					205						210	
Ser	Leu	Ile	Ile	Ile	Leu	Thr	Ser	Tyr	Met	Leu	Ile	Phe	Thr	Thr		
				215					220						225	
Ile	Met	Lys	Met	Arg	Ser	Ala	Ser	Gly	Arg	Gln	Lys	Thr	Phe	Ser		
				230					235						240	
Thr	Cys	Ala	Ser	His	Leu	Thr	Ala	Ile	Thr	Ile	Phe	His	Gly	Thr		
				245					250						255	
Ile	Leu	Phe	Leu	Tyr	Cys	Val	Pro	Asn	Pro	Lys	Thr	Ser	Ser	Leu		
				260					265						270	
Ile	Val	Thr	Val	Ala	Ser	Val	Phe	Tyr	Thr	Val	Ala	Ile	Pro	Met		
				275					280						285	
Leu	Asn	Pro	Leu	Ile	Tyr	Ser	Leu	Arg	Asn	Lys	Asp	Ile	Asn	Asn		
				290					295						300	
Met	Phe	Glu	Lys	Leu	Val	Val	Thr	Lys	Leu	Ile	Tyr	His				
				305					310							

<210> 10

<211> 313

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475293CD1

<400> 10

Met	Lys	Arg	Glu	Asn	Gln	Ser	Ser	Val	Ser	Glu	Phe	Leu	Leu	Leu		
1				5					10						15	
Asp	Leu	Pro	Ile	Trp	Pro	Glu	Gln	Gln	Ala	Val	Phe	Phe	Thr	Leu		
				20					25						30	
Phe	Leu	Gly	Met	Tyr	Leu	Ile	Thr	Val	Leu	Gly	Asn	Leu	Leu	Ile		
				35					40						45	
Ile	Leu	Leu	Ile	Arg	Leu	Asp	Ser	His	Leu	His	Thr	Pro	Met	Phe		
				50					55						60	
Phe	Phe	Leu	Ser	His	Leu	Ala	Leu	Thr	Asp	Ile	Ser	Leu	Ser	Ser		
				65					70						75	
Val	Thr	Val	Pro	Lys	Met	Leu	Leu	Ser	Met	Gln	Thr	Gln	Asp	Gln		
				80					85						90	
Ser	Ile	Leu	Tyr	Ala	Gly	Cys	Val	Thr	Gln	Met	Tyr	Phe	Phe	Ile		
				95					100						105	
Phe	Phe	Thr	Asp	Leu	Asp	Asn	Phe	Leu	Leu	Thr	Ser	Met	Ala	Tyr		
				110					115						120	
Asp	Arg	Tyr	Val	Ala	Ile	Cys	His	Pro	Leu	Arg	Tyr	Thr	Thr	Ile		
				125					130						135	
Met	Lys	Glu	Gly	Leu	Cys	Asn	Leu	Leu	Val	Thr	Val	Ser	Trp	Ile		
				140					145						150	
Leu	Ser	Cys	Thr	Asn	Ala	Leu	Ser	His	Thr	Leu	Leu	Leu	Ala	Gln		
				155					160						165	
Leu	Ser	Phe	Cys	Ala	Asp	Asn	Thr	Ile	Pro	His	Phe	Phe	Cys	Asp		
				170					175						180	
Leu	Val	Ala	Leu	Leu	Lys	Leu	Ser	Cys	Ser	Asp	Ile	Ser	Leu	Asn		
				185					190						195	

Glu	Leu	Val	Ile	Phe	Thr	Val	Gly	Gln	Ala	Val	Ile	Thr	Leu	Pro	
				200					205					210	
Leu	Ile	Cys	Ile	Leu	Ile	Ser	Tyr	Gly	His	Ile	Gly	Val	Thr	Ile	
				215					220					225	
Leu	Lys	Ala	Pro	Ser	Thr	Lys	Gly	Ile	Phe	Lys	Ala	Leu	Ser	Thr	
				230					235					240	
Cys	Gly	Ser	His	Leu	Ser	Val	Val	Ser	Leu	Tyr	Tyr	Gly	Thr	Ile	
				245					250					255	
Ile	Gly	Leu	Tyr	Phe	Leu	Pro	Ser	Ser	Ser	Ala	Ser	Ser	Asp	Lys	
				260					265					270	
Asp	Val	Ile	Ala	Ser	Val	Met	Tyr	Thr	Val	Ile	Thr	Pro	Leu	Leu	
				275					280					285	
Asn	Pro	Phe	Ile	Tyr	Ser	Leu	Arg	Asn	Arg	Asp	Ile	Lys	Gly	Ala	
				290					295					300	
Leu	Glu	Arg	Leu	Phe	Asn	Arg	Ala	Thr	Val	Leu	Ser	Gln			
				305					310						

<210> 11

<211> 309

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475297CD1

<400> 11

Met	Glu	Asn	Gln	Asn	Asn	Val	Thr	Glu	Phe	Ile	Leu	Leu	Gly	Leu	
1				5					10					15	
Thr	Glu	Asn	Leu	Glu	Leu	Trp	Lys	Ile	Phe	Ser	Ala	Val	Phe	Leu	
				20					25					30	
Val	Met	Tyr	Val	Ala	Thr	Val	Leu	Glu	Asn	Leu	Leu	Ile	Val	Val	
				35					40					45	
Thr	Ile	Ile	Thr	Ser	Gln	Ser	Leu	Arg	Ser	Pro	Met	Tyr	Phe	Phe	
				50					55					60	
Leu	Thr	Phe	Leu	Ser	Leu	Leu	Asp	Val	Met	Phe	Ser	Ser	Val	Val	
				65					70					75	
Ala	Pro	Lys	Val	Ile	Val	Asp	Thr	Leu	Ser	Lys	Ser	Thr	Thr	Ile	
				80					85					90	
Ser	Leu	Lys	Gly	Cys	Leu	Thr	Gln	Leu	Phe	Val	Glu	His	Phe	Phe	
				95					100					105	
Gly	Gly	Val	Gly	Ile	Ile	Leu	Leu	Thr	Val	Met	Ala	Tyr	Asp	Arg	
				110					115					120	
Tyr	Val	Ala	Ile	Cys	Lys	Pro	Leu	His	Tyr	Thr	Ile	Ile	Met	Ser	
				125					130					135	
Pro	Arg	Val	Cys	Cys	Leu	Met	Val	Gly	Gly	Ala	Trp	Val	Gly	Gly	
				140					145					150	
Phe	Met	His	Ala	Met	Ile	Gln	Leu	Leu	Phe	Met	Tyr	Gln	Ile	Pro	
				155					160					165	
Phe	Cys	Gly	Pro	Asn	Ile	Ile	Asp	His	Phe	Ile	Cys	Asp	Leu	Phe	
				170					175					180	
Gln	Leu	Leu	Thr	Leu	Ala	Cys	Thr	Asp	Thr	His	Ile	Leu	Gly	Leu	
				185					190					195	
Leu	Val	Thr	Leu	Asn	Ser	Gly	Met	Met	Cys	Val	Ala	Ile	Phe	Leu	
				200					205					210	
Ile	Leu	Ile	Ala	Ser	Tyr	Thr	Val	Ile	Leu	Cys	Ser	Leu	Lys	Ser	
				215					220					225	
Tyr	Ser	Ser	Lys	Gly	Arg	His	Lys	Ala	Leu	Ser	Thr	Cys	Ser	Ser	
				230					235					240	
His	Leu	Thr	Val	Val	Val	Leu	Phe	Phe	Val	Pro	Cys	Ile	Phe	Leu	
				245					250					255	
Tyr	Met	Arg	Pro	Val	Val	Thr	His	Pro	Ile	Asp	Lys	Ala	Met	Ala	
				260					265					270	

Val	Ser	Asp	Ser	Ile	Ile	Thr	Pro	Met	Leu	Asn	Pro	Leu	Ile	Tyr
				275					280					285
Thr	Leu	Arg	Asn	Ala	Glu	Val	Lys	Ser	Ala	Met	Lys	Lys	Leu	Trp
				290					295					300
Met	Lys	Trp	Glu	Ala	Leu	Ala	Gly	Lys						
				305										

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 <212> PRT
 <213> Homo sapiens

<220>
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 <223> Incyte ID No: 7475193CD1

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Met	Glu	Thr	Ala	Asn	Tyr	Thr	Lys	Val	Thr	Glu	Phe	Val	Leu	Thr
1				5					10					15
Gly	Leu	Ser	Gln	Thr	Pro	Glu	Val	Gln	Leu	Val	Leu	Phe	Val	Ile
				20					25					30
Phe	Leu	Ser	Phe	Tyr	Leu	Phe	Ile	Leu	Pro	Gly	Asn	Ile	Leu	Ile
				35					40					45
Ile	Cys	Thr	Ile	Ser	Leu	Asp	Pro	His	Leu	Thr	Ser	Pro	Met	Tyr
				50					55					60
Phe	Leu	Leu	Ala	Asn	Leu	Ala	Phe	Leu	Asp	Ile	Trp	Tyr	Ser	Ser
				65					70					75
Ile	Thr	Ala	Pro	Glu	Met	Leu	Ile	Asp	Phe	Phe	Val	Glu	Arg	Lys
				80					85					90
Ile	Ile	Ser	Phe	Asp	Gly	Cys	Ile	Ala	Gln	Leu	Phe	Phe	Leu	His
				95					100					105
Phe	Ala	Gly	Ala	Ser	Glu	Met	Phe	Leu	Leu	Thr	Val	Met	Ala	Phe
				110					115					120
Asp	Leu	Tyr	Thr	Ala	Ile	Cys	Arg	Pro	Leu	His	Tyr	Ala	Thr	Ile
				125					130					135
Met	Asn	Gln	Arg	Leu	Cys	Cys	Ile	Leu	Val	Ala	Leu	Ser	Trp	Arg
				140					145					150
Gly	Gly	Phe	Ile	His	Ser	Ile	Ile	Gln	Val	Ala	Leu	Ile	Val	Arg
				155					160					165
Leu	Pro	Phe	Cys	Gly	Pro	Asn	Glu	Leu	Asp	Ser	Tyr	Phe	Cys	Asp
				170					175					180
Ile	Thr	Gln	Val	Val	Arg	Ile	Ala	Cys	Ala	Asn	Thr	Phe	Pro	Glu
				185					190					195
Glu	Leu	Val	Met	Ile	Cys	Ser	Ser	Gly	Leu	Ile	Ser	Val	Val	Cys
				200					205					210
Leu	Ile	Ala	Leu	Leu	Met	Ser	Tyr	Ala	Phe	Leu	Leu	Ala	Leu	Phe
				215					220					225
Lys	Lys	Leu	Ser	Gly	Ser	Gly	Glu	Asn	Thr	Asn	Arg	Ala	Met	Ser
				230					235					240
Thr	Cys	Tyr	Ser	His	Ile	Thr	Ile	Val	Val	Leu	Met	Phe	Gly	Pro
				245					250					255
Ser	Ile	Tyr	Ile	Tyr	Ala	Arg	Pro	Phe	Asp	Ser	Phe	Ser	Leu	Asp
				260					265					270
Lys	Val	Val	Ser	Val	Phe	Asn	Thr	Leu	Ile	Phe	Pro	Leu	Arg	Asn
				275					280					285
Pro	Ile	Ile	Tyr	Thr	Leu	Arg	Asn	Lys	Glu	Val	Lys	Ala	Ala	Met
				290					295					300
Arg	Lys	Leu	Val	Thr	Lys	Tyr	Ile	Leu	Cys	Lys	Glu	Lys		
				305					310					

<210> 13
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<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475213CD1

<400> 13

Met	Lys	Arg	Lys	Asn	Phe	Thr	Glu	Val	Ser	Glu	Phe	Ile	Phe	Leu	
1				5					10					15	
Gly	Phe	Ser	Ser	Phe	Gly	Lys	His	Gln	Ile	Thr	Leu	Phe	Val	Val	
				20					25					30	
Phe	Leu	Thr	Val	Tyr	Ile	Leu	Thr	Leu	Val	Ala	Asn	Ile	Ile	Ile	
				35					40					45	
Val	Thr	Ile	Ile	Cys	Ile	Asp	His	His	Leu	His	Thr	Pro	Met	Tyr	
				50					55					60	
Phe	Phe	Leu	Ser	Met	Leu	Ala	Ser	Ser	Glu	Thr	Val	Tyr	Thr	Leu	
				65					70					75	
Val	Ile	Val	Pro	Arg	Met	Leu	Leu	Ser	Leu	Ile	Phe	His	Asn	Gln	
				80					85					90	
Pro	Ile	Ser	Leu	Ala	Gly	Cys	Ala	Thr	Gln	Met	Phe	Phe	Phe	Val	
				95					100					105	
Ile	Leu	Ala	Thr	Asn	Asn	Cys	Phe	Leu	Leu	Thr	Ala	Met	Gly	Tyr	
				110					115					120	
Asp	Arg	Tyr	Val	Ala	Ile	Cys	Arg	Pro	Leu	Arg	Tyr	Thr	Val	Ile	
				125					130					135	
Met	Ser	Lys	Gly	Leu	Cys	Ala	Gln	Leu	Val	Cys	Gly	Ser	Phe	Gly	
				140					145					150	
Ile	Gly	Leu	Thr	Met	Ala	Val	Leu	His	Val	Thr	Ala	Met	Phe	Asn	
				155					160					165	
Leu	Pro	Phe	Cys	Gly	Thr	Val	Val	Asp	His	Phe	Phe	Cys	Asp	Ile	
				170					175					180	
Tyr	Pro	Val	Met	Lys	Leu	Ser	Cys	Ile	Asp	Thr	Thr	Ile	Asn	Glu	
				185					190					195	
Ile	Ile	Asn	Tyr	Gly	Val	Ser	Ser	Phe	Val	Ile	Phe	Val	Pro	Ile	
				200					205					210	
Gly	Leu	Ile	Phe	Ile	Ser	Tyr	Val	Leu	Val	Ile	Ser	Ser	Ile	Leu	
				215					220					225	
Gln	Ile	Ala	Ser	Ala	Glu	Gly	Arg	Lys	Lys	Thr	Phe	Ala	Thr	Cys	
				230					235					240	
Val	Ser	His	Leu	Thr	Val	Val	Ile	Val	His	Cys	Gly	Cys	Ala	Ser	
				245					250					255	
Ile	Ala	Tyr	Leu	Lys	Pro	Lys	Ser	Glu	Ser	Ser	Ile	Glu	Lys	Asp	
				260					265					270	
Leu	Val	Leu	Ser	Val	Thr	Tyr	Thr	Ile	Ile	Thr	Pro	Leu	Leu	Asn	
				275					280					285	
Pro	Val	Val	Tyr	Ser	Leu	Arg	Asn	Lys	Glu	Ile	Gln	Glu	Ser	Leu	
				290					295					300	
Gln	Ala	Gly	Leu	Arg	Leu	Leu	Val	Ser	Val	Leu	Glu	Asp	Phe	Ser	
				305					310					315	
Phe	Glu	Ser	Phe	Leu	Ala	Pro	Ile	Leu	Pro	Glu	Leu	Ser	Asp	Ser	
				320					325					330	
Gln	Ile	Phe	Glu	Leu	Val	Trp	Leu	Gly	Asp	Val	Glu				
				335					340						

<210> 14

<211> 310

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475272CD1

<400> 14

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Met Ala Glu Met Asn Leu Thr Leu Val Thr Glu Phe Leu Leu Ile
 1          5          10          15
Ala Phe Thr Glu Tyr Pro Glu Trp Ala Leu Pro Leu Phe Leu Leu
          20          25          30
Leu Leu Phe Met Tyr Leu Ile Thr Val Leu Gly Asn Leu Glu Met
          35          40          45
Ile Ile Leu Ile Leu Met Asp His Gln Leu His Ala Pro Met Tyr
          50          55          60
Phe Leu Leu Ser His Leu Ala Phe Met Asp Val Cys Tyr Ser Ser
          65          70          75
Ile Thr Val Pro Gln Met Leu Ala Val Leu Leu Glu His Gly Ala
          80          85          90
Ala Leu Ser Tyr Thr Arg Cys Ala Ala Gln Phe Phe Leu Phe Thr
          95          100          105
Phe Phe Gly Ser Ile Asp Cys Tyr Leu Leu Ala Leu Met Ala Tyr
          110          115          120
Asp Arg Tyr Leu Ala Val Cys Gln Pro Leu Leu Tyr Val Thr Ile
          125          130          135
Leu Thr Gln Gln Ala Arg Leu Ser Leu Val Ala Gly Ala Tyr Val
          140          145          150
Ala Gly Leu Ile Ser Ala Leu Val Arg Thr Val Ser Ala Phe Thr
          155          160          165
Leu Ser Phe Cys Gly Thr Ser Glu Ile Asp Phe Ile Phe Cys Asp
          170          175          180
Leu Pro Pro Leu Leu Lys Leu Thr Cys Gly Glu Ser Tyr Thr Gln
          185          190          195
Glu Val Leu Ile Ile Met Phe Ala Ile Phe Val Ile Pro Ala Ser
          200          205          210
Met Val Val Ile Leu Val Ser Tyr Leu Phe Ile Ile Val Ala Ile
          215          220          225
Met Gly Ile Pro Ala Gly Ser Gln Ala Lys Thr Phe Ser Thr Cys
          230          235          240
Thr Ser His Leu Thr Ala Val Ser Leu Phe Phe Gly Thr Leu Ile
          245          250          255
Phe Met Tyr Leu Arg Gly Asn Ser Asp Gln Ser Ser Glu Lys Asn
          260          265          270
Arg Val Val Ser Val Leu Tyr Thr Glu Val Ile Pro Met Leu Asn
          275          280          285
Pro Leu Ile Tyr Ser Leu Arg Asn Lys Glu Val Lys Glu Ala Leu
          290          295          300
Arg Lys Ile Leu Asn Arg Ala Lys Leu Ser
          305          310

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<210> 15

<211> 302

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475200CD1

<400> 15

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Met Asp Ile Pro Gln Asn Ile Thr Glu Phe Phe Met Leu Gly Leu
 1          5          10          15
Ser Gln Asn Ser Glu Val Gln Arg Val Leu Phe Val Val Phe Leu
          20          25          30
Leu Ile Tyr Val Val Thr Val Cys Gly Asn Met Leu Ile Val Val
          35          40          45
Thr Ile Thr Ser Ser Pro Thr Leu Ala Ser Pro Val Tyr Phe Phe
          50          55          60
Leu Ala Asn Leu Ser Phe Ile Asp Thr Phe Tyr Ser Ser Ser Met

```

	65		70		75
Ala Pro Lys Leu	Ile	Ala Asp Ser Leu	Tyr Glu Gly Arg Thr	Ile	
	80		85		90
Ser Tyr Glu Cys	Cys Met Ala Gln Leu	Phe Gly Ala His Phe	Leu		
	95		100		105
Gly Gly Val Glu	Ile Ile Leu Leu Thr	Val Met Ala Tyr Asp	Arg		
	110		115		120
Tyr Val Ala Ile	Cys Lys Pro Leu His	Asn Thr Thr Ile Met	Thr		
	125		130		135
Arg His Leu Cys	Ala Met Leu Val Gly	Val Ala Trp Leu Gly	Gly		
	140		145		150
Phe Leu His Ser	Leu Val Gln Leu Leu	Leu Val Leu Trp Leu	Pro		
	155		160		165
Phe Cys Gly Pro	Asn Val Ile Asn His	Phe Ala Cys Asp Leu	Tyr		
	170		175		180
Pro Leu Leu Glu	Val Ala Cys Thr Asn	Thr Tyr Val Ile Gly	Leu		
	185		190		195
Leu Val Val Ala	Asn Ser Gly Leu Ile	Cys Leu Leu Asn Phe	Leu		
	200		205		210
Met Leu Ala Ala	Ser Tyr Ile Val Ile	Leu Tyr Ser Leu Arg	Ser		
	215		220		225
His Ser Ala Asp	Gly Arg Cys Lys Ala	Leu Ser Thr Cys Gly	Ala		
	230		235		240
His Phe Ile Val	Val Ala Leu Phe Phe	Val Pro Cys Ile Phe	Thr		
	245		250		255
Tyr Val His Pro	Phe Ser Thr Leu Pro	Ile Asp Lys Asn Met	Ala		
	260		265		270
Leu Phe Tyr Gly	Ile Leu Thr Pro Met	Leu Asn Pro Leu Ile	Tyr		
	275		280		285
Thr Leu Arg Asn	Glu Glu Val Lys Asn	Ala Met Arg Lys Leu	Phe		
	290		295		300
Thr Trp					

<210> 16

<211> 316

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475121CD1

<400> 16

Met Pro Ser Gln Asn Tyr Ser Ile Ile Ser Glu Phe Asn Leu Phe	
1 5 10 15	
Gly Phe Ser Ala Phe Pro Gln His Leu Leu Pro Ile Leu Phe Leu	
20 25 30	
Leu Tyr Leu Leu Met Phe Leu Phe Thr Leu Leu Gly Asn Leu Leu	
35 40 45	
Ile Met Ala Thr Ile Trp Ile Glu His Arg Leu His Thr Pro Met	
50 55 60	
Tyr Leu Phe Leu Cys Thr Leu Ser Val Ser Glu Ile Leu Phe Thr	
65 70 75	
Val Ala Ile Thr Pro Arg Met Leu Ala Asp Leu Leu Ser Thr His	
80 85 90	
His Ser Ile Thr Phe Val Ala Cys Ala Asn Gln Met Phe Phe Ser	
95 100 105	
Phe Met Phe Gly Phe Thr His Ser Phe Leu Leu Leu Val Met Gly	
110 115 120	
Tyr Asp Arg Tyr Val Ala Ile Cys His Pro Leu Arg Tyr Asn Val	
125 130 135	
Leu Met Ser Pro Arg Asp Cys Ala His Leu Val Ala Cys Thr Trp	

Ala Gly Gly Ser	140	145	150
Val Met Gly Met Met	155	160	165
His Leu Thr Phe Cys Gly Ser Asn Val	170	175	180
His Val Leu Ser Leu Leu Lys Leu Ala Cys Glu Asn Lys Thr Ser	185	190	195
Ser Val Ile Met Gly Val Met Leu Val Cys Val Thr Ala Leu Ile	200	205	210
Gly Cys Leu Phe Leu Ile Ile Leu Ser Tyr Val Phe Ile Val Ala	215	220	225
Ala Ile Leu Arg Ile Pro Ser Ala Glu Gly Arg His Lys Thr Phe	230	235	240
Ser Thr Cys Val Ser His Leu Thr Val Val Val Thr His Tyr Ser	245	250	255
Phe Ala Ser Phe Ile Tyr Leu Lys Pro Lys Gly Leu His Ser Met	260	265	270
Tyr Ser Asp Ala Leu Met Ala Thr Thr Tyr Thr Val Phe Thr Pro	275	280	285
Phe Leu Ser Pro Ile Ile Phe Ser Leu Arg Asn Lys Glu Leu Lys	290	295	300
Asn Ala Ile Asn Lys Asn Phe Tyr Arg Lys Phe Cys Pro Pro Ser	305	310	315
Ser			

<210> 17

<211> 370

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475165CD1

<400> 17

Met Leu Val Leu Asn Ser Trp Ala Gln Val Ile His Trp Pro Gln	1	5	10	15
Pro Pro Lys Val Leu Gly Leu Gln Pro Leu Glu Lys Thr Gln Tyr	20	25	30	
Gly Phe Leu Gly Thr Asp Arg Val Glu Glu Lys Thr Ser Val Ile	35	40	45	
Thr Ile Arg Val Ser Val Thr His Arg His Asn Ser Tyr Met Glu	50	55	60	
Ala Glu Asn Leu Thr Glu Leu Ser Lys Phe Leu Leu Leu Gly Leu	65	70	75	
Ser Asp Asp Pro Glu Leu Gln Pro Val Leu Phe Gly Leu Phe Leu	80	85	90	
Ser Met Tyr Leu Val Thr Val Leu Gly Asn Leu Leu Ile Ile Leu	95	100	105	
Ala Val Ser Ser Asp Ser His Leu His Thr Pro Met Tyr Phe Phe	110	115	120	
Leu Ser Asn Leu Ser Phe Val Asp Ile Cys Phe Ile Ser Thr Thr	125	130	135	
Val Pro Lys Met Leu Val Ser Ile Gln Ala Arg Ser Lys Asp Ile	140	145	150	
Ser Tyr Met Gly Cys Leu Thr Gln Val Tyr Phe Leu Met Met Phe	155	160	165	
Ala Gly Met Asp Thr Phe Leu Leu Ala Val Met Ala Tyr Asp Arg	170	175	180	
Phe Val Ala Ile Cys His Pro Leu His Tyr Thr Val Ile Met Asn	185	190	195	
Pro Cys Leu Cys Gly Leu Leu Val Leu Ala Ser Trp Phe Ile Ile				

	200		205		210
Phe Trp Phe Ser	Leu Val His Ile Leu	Leu Met Lys Arg Leu	Thr		
	215		220		225
Phe Ser Thr Gly	Thr Glu Ile Pro His	Phe Phe Cys Glu Pro	Ala		
	230		235		240
Gln Val Leu Lys	Val Ala Cys Ser Asn	Thr Leu Leu Asn Asn	Ile		
	245		250		255
Val Leu Tyr Val	Ala Thr Ala Leu Leu	Gly Val Phe Pro Val	Ala		
	260		265		270
Gly Ile Leu Phe	Ser Tyr Ser Gln Ile	Val Ser Ser Leu Met	Gly		
	275		280		285
Met Ser Ser Thr	Lys Gly Lys Tyr Lys	Ala Phe Ser Thr Cys	Gly		
	290		295		300
Ser His Leu Cys	Val Val Ser Leu Phe	Tyr Gly Thr Gly Leu	Gly		
	305		310		315
Val Tyr Leu Ser	Ser Ala Val Thr His	Ser Ser Gln Ser Ser	Ser		
	320		325		330
Thr Ala Ser Val	Met Tyr Ala Met Val	Thr Pro Met Leu Asn	Pro		
	335		340		345
Phe Ile Tyr Ser	Leu Arg Asn Lys Asp	Val Lys Gly Ala Leu	Glu		
	350		355		360
Arg Leu Leu Ser	Arg Ala Asp Ser Cys	Pro			
	365		370		

<210> 18

<211> 318

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475273CD1

<400> 18

Met Lys Asn Val	Thr Glu Val Thr Leu	Phe Val Leu Lys Gly	Phe
1	5	10	15
Thr Asp Asn Leu	Glu Leu Gln Thr Ile	Phe Phe Phe Leu	Phe Leu
	20	25	30
Ala Ile Tyr Leu	Phe Thr Leu Met Gly	Asn Leu Gly Leu	Ile Leu
	35	40	45
Val Val Ile Arg	Asp Ser Gln Leu His	Lys Pro Met Tyr Tyr	Phe
	50	55	60
Leu Ser Met Leu	Ser Ser Val Asp Ala	Cys Tyr Ser Ser	Val Ile
	65	70	75
Thr Pro Asn Met	Leu Val Asp Phe Thr	Thr Lys Asn Lys	Val Ile
	80	85	90
Ser Phe Leu Gly	Cys Val Ala Gln Val	Phe Leu Ala Cys	Ser Phe
	95	100	105
Gly Thr Thr Glu	Cys Phe Leu Leu Ala	Ala Met Ala Tyr	Asp Arg
	110	115	120
Tyr Val Ala Ile	Tyr Asn Pro Leu Leu	Tyr Ser Val Ser	Met Ser
	125	130	135
Pro Arg Val Tyr	Met Pro Leu Ile Asn	Ala Ser Tyr Val	Ala Gly
	140	145	150
Ile Leu His Ala	Thr Ile His Thr Val	Ala Thr Phe Ser	Leu Ser
	155	160	165
Phe Cys Gly Ala	Asn Glu Ile Arg Arg	Val Phe Cys Asp	Ile Pro
	170	175	180
Pro Leu Leu Ala	Ile Ser Tyr Ser Asp	Thr His Thr Asn	Gln Leu
	185	190	195
Leu Leu Phe Tyr	Phe Val Gly Ser Ile	Glu Leu Val Thr	Ile Leu
	200	205	210
Ile Val Leu Ile	Ser Tyr Gly Leu Ile	Leu Leu Ala Ile	Leu Lys

Met Tyr Ser Ala	215	Gly Arg Arg Lys	220	Val Phe Ser Thr Cys Gly	225
	230		235		240
Ala His Leu Thr	245	Gly Val Ser Ile Tyr	250	Tyr Gly Thr Ile Leu Phe	255
Met Tyr Val Arg	260	Pro Ser Ser Ser Tyr	265	Ala Ser Asp His Asp Met	270
Ile Val Ser Ile	275	Phe Tyr Thr Ile Val	280	Ile Pro Leu Leu Asn Pro	285
Val Ile Tyr Ser	290	Leu Arg Asn Lys Asp	295	Val Lys Asp Ser Met Lys	300
Lys Met Phe Gly	305	Lys Asn Gln Val Ile	310	Asn Lys Val Tyr Phe His	315
Thr Lys Lys					

<210> 19

<211> 321

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7476077CD1

<400> 19

Met Glu Ser Pro Asn His Thr Asp Val Asp Pro Ser Val Phe Phe	1	5	10	15
Leu Leu Gly Ile Pro Gly Leu Glu Gln Phe His Leu Trp Leu Ser	20	25	30	
Leu Pro Val Cys Gly Leu Gly Thr Ala Thr Ile Val Gly Asn Ile	35	40	45	
Thr Ile Leu Val Val Val Ala Thr Glu Pro Val Leu His Lys Pro	50	55	60	
Val Tyr Leu Phe Leu Cys Met Leu Ser Thr Ile Asp Leu Ala Ala	65	70	75	
Ser Val Ser Thr Val Pro Lys Leu Leu Ala Ile Phe Trp Cys Gly	80	85	90	
Ala Gly His Ile Ser Ala Ser Ala Cys Leu Ala Gln Met Phe Phe	95	100	105	
Ile His Ala Phe Cys Met Met Glu Ser Thr Val Leu Leu Ala Met	110	115	120	
Ala Phe Asp Arg Tyr Val Ala Ile Cys His Pro Leu Arg Tyr Ala	125	130	135	
Thr Ile Leu Thr Asp Thr Ile Ile Ala His Ile Gly Val Ala Ala	140	145	150	
Val Val Arg Gly Ser Leu Leu Met Leu Pro Cys Pro Phe Leu Ile	155	160	165	
Gly Arg Leu Asn Phe Cys Gln Ser His Val Ile Leu His Thr Tyr	170	175	180	
Cys Glu His Met Ala Val Val Lys Leu Ala Cys Gly Asp Thr Arg	185	190	195	
Pro Asn Arg Val Tyr Gly Leu Thr Ala Leu Leu Val Ile Gly	200	205	210	
Val Asp Leu Phe Cys Ile Gly Leu Ser Tyr Ala Leu Ser Ala Gln	215	220	225	
Ala Val Leu Arg Leu Ser Ser His Glu Ala Arg Ser Lys Ala Leu	230	235	240	
Gly Thr Cys Gly Ser His Val Cys Val Ile Leu Ile Ser Tyr Thr	245	250	255	
Pro Ala Leu Phe Ser Phe Phe Thr His Arg Phe Gly His His Val	260	265	270	
Pro Val His Ile His Ile Leu Leu Ala Asn Val Tyr Leu Leu Leu				

Pro	Pro	Ala	Leu	275	Asn	Pro	Val	Val	Tyr	280	Gly	Val	Lys	Thr	Lys	285	Gln
				290						295							300
Ile	Arg	Lys	Arg	Val	Val	Arg	Val		Phe	Gln	Ser	Gly	Gln	Gly		Met	
				305						310							315
Gly	Ile	Lys	Ala	Ser	Glu												
				320													

<210> 20

<211> 313

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7476113CD1

<400> 20

Met	Leu	Leu	Thr	Asp	Arg	Asn	Thr	Ser	Gly	Thr	Thr	Phe	Thr	Leu			
1				5					10					15			
Leu	Gly	Phe	Ser	Asp	Tyr	Pro	Glu	Leu	Gln	Val	Pro	Leu	Phe	Leu			
				20					25					30			
Val	Phe	Leu	Ala	Ile	Tyr	Asn	Val	Thr	Val	Leu	Gly	Asn	Ile	Gly			
				35					40					45			
Leu	Ile	Val	Ile	Ile	Lys	Ile	Asn	Pro	Lys	Leu	His	Thr	Pro	Met			
				50					55					60			
Tyr	Phe	Phe	Leu	Ser	Gln	Leu	Ser	Phe	Val	Asp	Phe	Cys	Tyr	Ser			
				65					70					75			
Ser	Ile	Ile	Ala	Pro	Lys	Met	Leu	Val	Asn	Leu	Val	Val	Lys	Asp			
				80					85					90			
Arg	Thr	Ile	Ser	Phe	Leu	Gly	Cys	Val	Val	Gln	Phe	Phe	Phe	Phe			
				95					100					105			
Cys	Thr	Phe	Val	Val	Thr	Glu	Ser	Phe	Leu	Leu	Ala	Val	Met	Ala			
				110					115					120			
Tyr	Asp	Arg	Phe	Val	Ala	Ile	Cys	Asn	Pro	Leu	Leu	Tyr	Thr	Val			
				125					130					135			
Asn	Met	Ser	Gln	Lys	Leu	Cys	Val	Leu	Leu	Val	Val	Gly	Ser	Tyr			
				140					145					150			
Ala	Trp	Gly	Val	Ser	Cys	Ser	Leu	Glu	Leu	Thr	Cys	Ser	Ala	Leu			
				155					160					165			
Lys	Leu	Cys	Phe	His	Gly	Phe	Asn	Thr	Ile	Asn	His	Phe	Phe	Cys			
				170					175					180			
Glu	Phe	Ser	Ser	Leu	Leu	Ser	Leu	Ser	Cys	Ser	Asp	Thr	Tyr	Ile			
				185					190					195			
Asn	Gln	Trp	Leu	Leu	Phe	Phe	Leu	Ala	Thr	Phe	Asn	Glu	Ile	Ser			
				200					205					210			
Thr	Leu	Leu	Ile	Val	Leu	Thr	Ser	Tyr	Ala	Phe	Ile	Val	Val	Thr			
				215					220					225			
Ile	Leu	Lys	Met	Arg	Ser	Val	Ser	Gly	Arg	Arg	Lys	Ala	Phe	Ser			
				230					235					240			
Thr	Cys	Ala	Ser	His	Leu	Thr	Ala	Ile	Thr	Ile	Phe	His	Gly	Thr			
				245					250					255			
Ile	Leu	Phe	Leu	Tyr	Cys	Val	Pro	Asn	Ser	Lys	Asn	Ser	Arg	His			
				260					265					270			
Thr	Val	Lys	Val	Ala	Ser	Val	Phe	Tyr	Thr	Val	Val	Ile	Pro	Met			
				275					280					285			
Leu	Asn	Pro	Leu	Ile	Tyr	Ser	Leu	Arg	Asn	Lys	Asp	Val	Lys	Asp			
				290					295					300			
Thr	Val	Thr	Glu	Ile	Leu	Asp	Thr	Lys	Val	Phe	Ser	Tyr					
				305					310								

<210> 21

<211> 328


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Met Asn His Met Ser Ala Ser Leu Lys Ile Ser Asn Ser Ser Lys
 1          5          10
Phe Gln Val Ser Glu Phe Ile Leu Leu Gly Phe Pro Gly Ile His
 20          25          30
Ser Trp Gln His Trp Leu Ser Leu Pro Leu Ala Leu Leu Tyr Leu
 35          40          45
Ser Ala Leu Ala Ala Asn Thr Leu Ile Leu Ile Ile Ile Trp Gln
 50          55          60
Asn Pro Ser Leu Gln Gln Pro Met Tyr Ile Phe Leu Gly Ile Leu
 65          70          75
Cys Met Val Asp Met Gly Leu Ala Thr Thr Ile Ile Pro Lys Ile
 80          85          90
Leu Ala Ile Phe Trp Phe Asp Ala Lys Val Ile Ser Leu Pro Glu
 95          100          105
Cys Phe Ala Gln Ile Tyr Ala Ile His Phe Phe Val Gly Met Glu
 110          115          120
Ser Gly Ile Leu Leu Cys Met Ala Phe Asp Arg Tyr Val Ala Ile
 125          130          135
Cys His Pro Leu Arg Tyr Pro Ser Ile Val Thr Ser Ser Leu Ile
 140          145          150
Leu Lys Ala Thr Leu Phe Met Val Leu Arg Asn Gly Leu Phe Val
 155          160          165
Thr Pro Val Pro Val Leu Ala Ala Gln Arg Asp Tyr Cys Ser Lys
 170          175          180
Asn Glu Ile Glu His Cys Leu Cys Ser Asn Leu Gly Val Thr Ser
 185          190          195
Leu Ala Cys Asp Asp Arg Arg Pro Asn Ser Ile Cys Gln Leu Val
 200          205          210
Leu Ala Trp Leu Gly Met Gly Ser Asp Leu Ser Leu Ile Ile Leu
 215          220          225
Ser Tyr Ile Leu Ile Leu Tyr Ser Val Leu Arg Leu Asn Ser Ala
 230          235          240
Glu Ala Ala Ala Lys Ala Leu Ser Thr Cys Ser Ser His Leu Thr
 245          250          255
Leu Ile Leu Phe Phe Tyr Thr Ile Val Val Val Ile Ser Val Thr
 260          265          270
His Leu Thr Glu Met Lys Ala Thr Leu Ile Pro Val Leu Leu Asn
 275          280          285
Val Leu His Asn Ile Ile Pro Pro Ser Leu Asn Pro Thr Val Tyr
 290          295          300
Ala Leu Gln Thr Lys Glu Leu Arg Ala Ala Phe Gln Lys Val Leu
 305          310          315
Phe Ala Leu Thr Lys Glu Ile Arg Ser
 320

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<210> 23

<211> 315

<212> PRT

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7476112CD1

<400> 23

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Met Gln Gly Leu Asn His Thr Ser Val Ser Glu Phe Ile Leu Val
 1          5          10          15
Gly Phe Ser Ala Phe Pro His Leu Gln Leu Met Leu Phe Leu Leu
 20          25          30
Phe Leu Leu Met Tyr Leu Phe Thr Leu Leu Gly Asn Leu Leu Ile
 35          40          45
Met Ala Thr Val Trp Ser Glu Arg Ser Leu His Met Pro Met Tyr
 50          55          60

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Leu	Phe	Leu	Cys	Ala	Leu	Ser	Ile	Thr	Glu	Ile	Leu	Tyr	Thr	Val	
				65					70					75	
Ala	Ile	Ile	Pro	Arg	Met	Leu	Ala	Asp	Leu	Leu	Ser	Thr	Gln	Arg	
				80					85					90	
Ser	Ile	Ala	Phe	Leu	Ala	Cys	Ala	Ser	Gln	Met	Phe	Phe	Ser	Phe	
				95					100					105	
Ser	Phe	Gly	Phe	Thr	His	Ser	Phe	Leu	Leu	Thr	Val	Met	Gly	Tyr	
				110					115					120	
Asp	Arg	Tyr	Val	Ala	Ile	Cys	His	Pro	Leu	Arg	Tyr	Asn	Val	Leu	
				125					130					135	
Met	Ser	Leu	Arg	Gly	Cys	Thr	Cys	Arg	Val	Gly	Cys	Ser	Trp	Ala	
				140					145					150	
Gly	Gly	Leu	Val	Met	Gly	Met	Val	Val	Thr	Ser	Ala	Ile	Phe	His	
				155					160					165	
Leu	Ala	Phe	Cys	Gly	His	Lys	Glu	Ile	His	His	Phe	Phe	Cys	His	
				170					175					180	
Val	Pro	Pro	Leu	Leu	Lys	Leu	Ala	Cys	Gly	Asp	Asp	Val	Leu	Val	
				185					190					195	
Val	Ala	Lys	Gly	Val	Gly	Leu	Val	Cys	Ile	Thr	Ala	Leu	Leu	Gly	
				200					205					210	
Cys	Phe	Leu	Leu	Ile	Leu	Leu	Ser	Tyr	Ala	Phe	Ile	Val	Ala	Ala	
				215					220					225	
Ile	Leu	Lys	Ile	Pro	Ser	Ala	Glu	Gly	Arg	Asn	Lys	Ala	Phe	Ser	
				230					235					240	
Thr	Cys	Ala	Ser	His	Leu	Thr	Val	Val	Val	Val	His	Tyr	Gly	Phe	
				245					250					255	
Ala	Ser	Val	Ile	Tyr	Leu	Lys	Pro	Lys	Gly	Pro	Gln	Ser	Pro	Glu	
				260					265					270	
Gly	Asp	Thr	Leu	Met	Gly	Ile	Thr	Tyr	Thr	Val	Leu	Thr	Pro	Phe	
				275					280					285	
Leu	Ser	Pro	Ile	Ile	Phe	Ser	Leu	Arg	Asn	Lys	Glu	Leu	Lys	Val	
				290					295					300	
Ala	Met	Lys	Lys	Thr	Cys	Phe	Thr	Lys	Leu	Phe	Pro	Gln	Asn	Cys	
				305					310					315	

<210> 24

<211> 2739

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475208CB1

<400> 24

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gccccattgt	gctgtgcaca	gcaacttagg	atgaaggggg	actacgtgct	gggggggctg	120
ttccccctgg	gcgaggcoga	ggaggctggc	ctccgcagcc	ggacacggcc	cagcagccct	180
gtgtgcacca	ggttctctc	aaacggcctg	ctctgggcac	tggccatgaa	aatggccgtg	240
gaggagatca	acaacaagtc	ggatctgctg	cccgggctgc	gcctgggcta	cgacctctt	300
gatacgtgct	cggagcctgt	ggtggccatg	aagcccagcc	tcatgttctt	ggccaaggca	360
ggcagccgcg	acatcgccgc	ctactgcaac	tacacgcagt	accagccccc	tgtgctggct	420
gtcatcgggc	cccactcgtc	agagctcgcc	atggtcaccg	gcaagttctt	cagcttcttc	480
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<210> 25

<211> 993

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475101CB1

<400> 25

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cagcctcttc tgtttggcat cttccttggc atgtacctgg tcaccatggt ggggaacctg 180
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gccaacctgt cattaactga tgctgtttc acttctgcct ccatecccaa aatgctggcc 300
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<210> 26

<211> 990

<212> DNA

<213> Homo sapiens

<220>
<221> misc_feature
<223> Incyte ID No: 7475152CB1

<220>
<221> unsure
<222> 1
<223> a, t, c, g, or other

<400> 26
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<210> 27
<211> 1125
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<223> Incyte ID No: 7475164CB1

<400> 27
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<210> 28
<211> 939
<212> DNA
<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475170CB1

<400> 28

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gggaacaaaa ccattcattgt attatctcac ttggaccac atcttcacac tccatgtat 180
ttttttctt ccaacctaaag ctttttggat ctgtgttaca caaccggcat tgttccacag 240
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ctgtacatct ctctaggctt gggatctaca gaatgcgttc tcttaggagt gatggtat 360
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tttgtcagtg tcattattct tcttgtacct gttgcattaa tcatattctc ctatagtcag 660
attgtcaggg cagtcagag gataaagtta gcaacagggc agagaaaagt gtttgggaca 720
tgtggtctcc acctcacagt ggtttccctg ttctacggca cagctatcta tgcctacctc 780
cagcccgga acaactactc tcaggatcag ggcaagttca tctctctctt ctacaccatc 840
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<210> 29

<211> 978

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475197CB1

<400> 29

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<210> 30

<211> 936

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475210CB1

<400> 30

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caacagcagt cctcttctgg aattttctgt tgtatgtatc ttgtcacctt gactgggaac 120
ctgctcatca tctggccat tggctctgac ctgcacctcc acaccccat gtactttttc 180

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ttggccaacc tgtcttttgt tgacatgggt ttaacgtcct ccacagttac caagatgctg 240
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ttctttctga tgtttgggtga tctagacagc ttcttctcgg ctgccatggc gtatgaccgc 360
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<210> 31

<211> 1035

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475221CB1

<400> 31

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atcctcttag ggctcacaca gaacctgag gggcaaaagg ttttatttgt cacattctta 180
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<210> 32

<211> 942

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475244CB1

<400> 32

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atggcatctg aaagaaatca aagcagcaca cccactttta ttctcttggg tttttcagaa 60
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gtggggaact tgggcatgat aataatcatc agactcaatt caaaactcca tacaatcatg 180
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acctgtgcct cccacctgac agccatcact atcttccatg gaactatcct tttcctttac 780
tgtgttccta atcctaaaac ttctagcctc atagttagag tggcttctgt gttttacaca 840
gtggcgattc caatgctgaa cccattgatc tacagcetta ggaacaaaga tatcaataac 900
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<210> 33

<211> 942

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475293CB1

<400> 33

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tgtaacttac tagtcaactgt gtcctggatc ctctcctgta ccaatgccct gtctcacact 480
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<210> 34

<211> 930

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475297CB1

<400> 34

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ctacttattg tggttaactat tatcacaagt cagagtctga ggtcacctat gtattttttt 180
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atgaaatggg aggctttggc tgggaaataa 930

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<210> 35

<211> 942

<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<223> Incyte ID No: 7475193CB1

<400> 35
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ggaaatatac ttatcatttg caccatcagt ctagaccctc atctgacctc tctatgtat 180
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<211> 1029
<212> DNA
<213> Homo sapiens

<220>
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<223> Incyte ID No: 7475213CB1

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gtaagttcat ttgtgatttt tgtgccata ggccatgat tttatctcta tgtccttgtc 660
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<211> 933
<212> DNA
<213> Homo sapiens

<220>
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<223> Incyte ID No: 7475272CB1

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ctccctcttc tgttaaagt gacctgtggg gagagctaca ctcaagaagt gctgattatt 600
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acctccacc tcactgctgt gtcactcttc tttggtaccc tcactctcat gtacttgaga 780
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<210> 38
<211> 948
<212> DNA
<213> Homo sapiens

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<223> a, t, c, g, or other

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gtctttttgc tgatctatgt ggtcacgggt tgtggcaaca tgctcattgt ggtcactatc 180
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gggcccattg tgatcaatca ctttgctgtg gacttgtagc ctttgctgga agttgcctgc 600
accaatacgt atgtcattgg tctgctgggt gttgccaaaca gtggtttaat ctgectgttg 660
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<210> 39
<211> 951
<212> DNA
<213> Homo sapiens

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<220>
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<223> Incyte ID No: 7475121CB1

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ctgggcaacc ttctcatcat ggccacaatc tggattgaac acagactcca cacacccatg 180

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tacctcttct tgtgcacct ctccgtctct gagattctgt tcaactgttg catcacccct 240
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cagatgttct tctccttcat gtttggtctt actcaactct tcttctctct ggtcatgggc 360
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gactgtgccc atcttgtggc ctgtacctgg gctgggtggc cagtcatggg gatgatgggt 480
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<210> 40

<211> 1113

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475165CB1

<400> 40

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gcagaaaacc ttacagaatt atcaaaattt ctctctctgg gactctcaga tgatcctgaa 240
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agactctca gcagggccga ctctgttcca tga 1113

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<210> 41

<211> 957

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7475273CB1

<400> 41

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tatgtagcca tctacaaccc tctctgtat tcagtgcagc tgtcaccagc agtctacatg 420
ccactcatca atgcttctta tgttgctggc attttacatg ctactataca tacagtggct 480
acatttagcc tatccttctg tggagccaat gaaattaggc gtgtcttttg tgatatccct 540

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<210> 42

<211> 966

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<223> Incyte ID No: 7476077CB1

<400> 42

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<210> 43

<211> 975

<212> DNA

<213> Homo sapiens

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<221> misc_feature

<223> Incyte ID No: 7476113CB1

<220>

<221> unsure

<222> 1

<223> a, t, c, g, or other

<400> 43

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ctgggtttttc tggccatcta caatgtcact gtgctaggga atattgggtt gattgtgatc 180
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gacagaacca ttctattttt aggatgcgta gtacaattct ttttcttctg tacctttgtg 360
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cctctgctct acacagttaa catgtcccag aaactctgcg tgctgtgggt tgtgggatcc 480
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catggtttca acacaatcaa tcacttcttc tgtgagttct cctcactact ctccctttct 600
tgctctgata cttacatcaa ccagtggctg ctattcttct ttgccacctt taatgaaatc 660
agcacactac tcatcgttct cacatcttat gcgttcattg ttgtaacct cctcaagatg 720

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cgttcagtcg  gtgggcgcgc  caaagccttc  tccacctgtg  cctcccacct  gactgccatc  780
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cacacagtcg  aagtggcctc  tgtgttttac  accgtggtga  tccccatgtt  gaatcccctg  900
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<210> 44
 <211> 987
 <212> DNA
 <213> Homo sapiens

<220>
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<210> 45
 <211> 975
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
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gcactactgt  atctctcagc  acttgctgca  aacaccctca  tctctatcat  catctggcag  180
aacccttctt  tacagcagcc  catgtatatt  ttccttggca  tctctgtgat  ggtagacatg  240
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agtcttatta  tactgtcata  tattttgatt  ctgtactctg  tacttagact  gaactcagct  720
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<210> 46

<211> 948
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<223> Incyte ID No: 7476112CB1

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gccatgaaga agacttgctt caccaaactc tttccacaga actgctga 948

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Published:

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: G-PROTEIN COUPLED RECEPTORS

(57) Abstract: The invention provides human G-protein coupled receptors (GCREC) and polynucleotides which identify and encode GCREC. The invention also provides expression vectors, host cells, antibodies, agonists, and antagonists. The invention also provides methods for diagnosing, treating, or preventing disorders associated with aberrant expression of GCREC.



WO 01/090359 A3

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/US 01/16833

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C12N15/12 C12N15/10 C12Q1/68 C07K14/705 C07K16/28
A01K67/027 A61K38/17 A61K39/395 G01N33/53 G01N33/577

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C12N C12Q C07K A01K A61K G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

SEQUENCE SEARCH, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 01 83749 A (WARNER-LAMBERT CO (US) MONELL CHEMICAL SENSES CTR (US) BACHMANOV ET AL) 8 November 2001 (2001-11-08) SEQ ID NO:4, 5 page 42 -page 46 ---	1,3, 6-16, 18-26, 29-34, 36,37, 39-44
E	WO 01 64882 A (MILLENNIUM PHARMACEUTICALS INC (US) GLUCKSMANN; GALVIN; SILOS-SANTIAGO) 7 September 2001 (2001-09-07) SEQ ID NO:13-15 figure 15 --- -/-	1,3, 6-16, 18-26, 29-34, 36,37, 39-44

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
 "E" earlier document but published on or after the international filing date
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
 "O" document referring to an oral disclosure, use, exhibition or other means
 "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
 "&" document member of the same patent family

Date of the actual completion of the international search

5 April 2002

Date of mailing of the international search report

12. 07. 2002

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INTERNATIONAL SEARCH REPORT

International Application No.
PCT/US 01/16833

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	<p>WO 01 98323 A (INCYTE GENOMICS INC (US) LAL GRAUL HAFALIA WALIA THORNTON NGUYEN ET AL) 27 December 2001 (2001-12-27)</p> <p>SEQ ID NO:2, 12 page 80 -page 82</p> <p>---</p>	<p>1,3, 6-16, 18-26, 29-34, 36,37, 39-44</p>
E	<p>WO 01 66563 A (SENOVYX INC (US); ADLER JE ZUZULYA S; O'CONNELL SM; LI X; STASZEWSKI L) 13 September 2001 (2001-09-13)</p> <p>page 34 page 41 SEQ ID NO:3, 4 page 69 -page 74; example 1</p> <p>---</p>	<p>1,3, 6-16, 18-26, 29-34, 36,37, 39-44</p>
A	<p>WO 00 06592 A (CALIFORNIA UNIV; DPT HEALTH & HUMAN SERVICES (US) ZUKER ADLER ET AL) 10 February 2000 (2000-02-10) the whole document</p> <p>---</p>	
A	<p>HOON M.A. ET AL.: "Putative mammalian taste receptors: a class of taste-specific GPCRs with distinct topography selectivity" CELL, vol. 96, 19 February 1999 (1999-02-19), pages 541-551, XP000922524 ISSN: 0092-8674 the whole document</p> <p>-----</p>	

INTERNATIONAL SEARCH REPORT

Internat on No.
PCT/US 01/16833

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
see FURTHER INFORMATION sheet PCT/ISA/210
2. ☒ Claims Nos.: **20, 21 all totally; 23, 24 all partially**
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

45, 68 all totally 1-44 all partially

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.1

Although claims 18 and 24 are directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.
Although claims 32 and 34 are directed to a diagnostic method practised on the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.

Continuation of Box I.2

Claims Nos.: 20, 21 all totally; 23, 24 all partially

Present claim 20 refers to a composition comprising an agonist of the polypeptide(s) of present invention without giving a true technical characterization of said agonist. Present claim 21 refers to a method involving said agonist.

Moreover, no specific compounds are defined in the application.

In consequence, the scope of said claims is ambiguous and vague and their subject-matter is not sufficiently disclosed and supported (Articles 5 and 6 PCT).

No search can be carried out for such purely speculative claims whose wording is, in act, a mere recitation of the result to be achieved.

Present claim 23 refers to a composition comprising an antagonist of the polypeptide(s) of present invention. Present claim 24 refers to a method involving said antagonist.

The claims cover all products having this antagonistic property, whereas the application provides support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT for only a very limited number of such products.

In fact, on page 37, only antibodies are mentioned as possible antagonists of the polypeptide(s) of the present invention.

In the present case, the claims so lack support, and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Independent of the above reasoning, the claims also lack clarity (Article 6 PCT). An attempt is made to define the product by reference to a result to be achieved. Again, this lack of clarity in the present case is such as to render a meaningful search over the whole of the claimed scope impossible. Consequently, the search has been carried out for those parts of the claims which appear to be clear, supported and disclosed, namely those parts relating to antibodies raised against the polypeptide(s) of present invention, as mentioned in page 37 of present application.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 45, 68 all totally; 1-44 all partially

Polypeptide comprising the sequence of SEQ ID NO:1, fragments and homologous polypeptides thereof.
Polynucleotide comprising the sequence of SEQ ID NO:24, homologous or complementary polynucleotides thereof.
Related cells, non-human transgenic organisms, methods, antibodies, compositions, tests.

2. Claims: 46, 69 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:2 and the polynucleotide as in SEQ ID NO:25.

3. Claims: 47, 70 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:3 and the polynucleotide as in SEQ ID NO:26.

4. Claims: 48, 71 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:4 and the polynucleotide as in SEQ ID NO:27.

5. Claims: 49, 72 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:5 and the polynucleotide as in SEQ ID NO:28.

6. Claims: 50, 73 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:6 and the polynucleotide as in SEQ ID NO:29.

7. Claims: 51, 74 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:7 and the polynucleotide as in SEQ ID NO:30.

8. Claims: 52, 75 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:8 and the polynucleotide as in SEQ ID NO:31.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

9. Claims: 53, 76 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:9 and the polynucleotide as in SEQ ID NO:32.

10. Claims: 54, 77 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:10 and the polynucleotide as in SEQ ID NO:33.

11. Claims: 55, 78 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:11 and the polynucleotide as in SEQ ID NO:34.

12. Claims: 56, 79 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:12 and the polynucleotide as in SEQ ID NO:35.

13. Claims: 57, 80 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:13 and the polynucleotide as in SEQ ID NO:36.

14. Claims: 58, 81 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:14 and the polynucleotide as in SEQ ID NO:37.

15. Claims: 59, 82 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:15 and the polynucleotide as in SEQ ID NO:38.

16. Claims: 60, 83 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:16 and the polynucleotide as in SEQ ID NO:39.

17. Claims: 61, 84 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:17 and the polynucleotide as in SEQ ID NO:40.

18. Claims: 62, 85 all totally; 1-44 all partially

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

As subject 1 but related to the polypeptide as in SEQ ID NO:18 and the polynucleotide as in SEQ ID NO:41.

19. Claims: 63, 86 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:19 and the polynucleotide as in SEQ ID NO:42.

20. Claims: 64, 87 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:20 and the polynucleotide as in SEQ ID NO:43.

21. Claims: 65, 88 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:21 and the polynucleotide as in SEQ ID NO:44.

22. Claims: 66, 89 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:22 and the polynucleotide as in SEQ ID NO:45.

23. Claims: 67, 90 all totally; 1-44 all partially

As subject 1 but related to the polypeptide as in SEQ ID NO:23 and the polynucleotide as in SEQ ID NO:46.

INTERNATIONAL SEARCH REPORT

tion on patent family members

Internatio plication No

PCT/US 01/16833

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